THIRTY-SIXTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

STATE BOARD OF AGRICULTURE

OF THE

STATE OF MICHIGAN

AND

TENTH ANNUAL REPORT

OF THE

EXPERIMENT STATION

FROM

JULY 1, 1896, TO JUNE 30, 1897

BY AUTHORITY

LANSING
ROBERT SMITH PRINTING CO., STATE PRINTERS AND BINDERS
1898

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REPORT OF THE SECRETARY

OF THE

STATE BOARD OF AGRICULTURE

AGRICULTURAL COLLEGE,
July 1, 1897.

TO HON. HAZEN S. PINGREE,

Governor of the State of Michigan:

SIR—I have the honor to submit to you herewith, as required by statute, the accompanying report for the fiscal year ending June 30, 1897, with supplementary papers.

Very respectfully,

IRA H. BUTTERFIELD,

Secretary of the State Board of Agriculture.

STATE BOARD OF AGRICULTURE.

		Term expires.
FRANKLIN WELLS, Constantine,	- - - - - -	1901
PRESIDENT OF THE BOARD.		
CHAS. W. GARFIELD, Grand Rapids,	- - - - -	1899
CHAS. F. MOORE, St. Clair,	- - - - - - - - -	1899
CHAS J. MONROE, South Haven,	- - - - - - -	1901
ARTHUR C. BIRD, Highland,	- - - - - - - -	1903
T. FRANK MARSTON, Bay City,	- - - - - - -	1903
HAZEN S. PINGREE, GOVERNOR OF THE STATE,	} *Ex officio.*	
JONATHAN L. SNYDER, PRES. OF THE COLLEGE,		

IRA H. BUTTERFIELD, AGRICULTURAL COLLEGE, SECRETARY.
BENJAMIN F. DAVIS, LANSING, TREASURER.

STANDING COMMITTEES.

The President of the Board is *ex officio* a member of each of the Standing Committees:

FINANCE, - - - - - -	C. W. Garfield, A. C. Bird.
FARM MANAGEMENT, - - -	T. F. Marston, A. C. Bird.
BOTANY AND HORTICULTURE, -	C. W. Garfield, C. J. Monroe.
BUILDINGS AND PROPERTY, -	C. F. Moore, C. J. Monroe.
EMPLOYEES, - - - - -	C. J. Monroe, C. F. Moore, J. L. Snyder.
FARMERS' INSTITUTES, - -	C. J. Monroe, C. W. Garfield.
MECHANICS, - - - - -	C. F. Moore, T. F. Marston.
VETERINARY DEP'T, - - - -	A. C. Bird, T. F. Marston.
COLLEGE LAND GRANT, - -	A. C. Bird, C. W. Garfield.
MILITARY DEP'T, - - - -	T. F. Marston, C. F. Moore.
STATE WEATHER SERVICE, - -	C. J. Monroe, T. F. Marston.
EXPERIMENT STATION, - -	Chas. W. Garfield, C. F. Moore.
LIBRARY, - - - - - -	A. C. Bird, C. W. Garfield.

STATE AGRICULTURAL COLLEGE.

(Under Control of the State Board of Agriculture.)

FACULTY AND OTHER OFFICERS.

Jonathan L. Snyder, Ph., D., President; [c] Feb. 25, '96.

Robert C. Kedzie, M. A., M. D., Professor of Chemistry and Curator of the Chemical Laboratory; [a,b,c] Feb. 25, '63.

Wm. J. Beal, M. A., Ph. D., Professor of Botany and Forestry and Curator of the Botanical Museum; [a,b] July 9, '70; [c] Feb. 22, '71.

E. A. A. Grange, V. S., Professor of Veterinary Science; [a,b,c] May 22, '83.

Levi R. Taft, M. S., Professor of Horticulture and Landscape Gardening, and Superintendent of the Horticultural Department; [a,b,c] Aug. 1, '88.

Howard Edwards, M. A., LL. D., Professor of English Literature and Modern Languages; [a,b,c] Aug. 25, '90.

Herman K. Vedder, C. E., Professor of Mathematics and Civil Engineering; [a,b,c] Sept. 15, '91.

Ira H. Butterfield, Secretary; [a,b,c] July 1, '93.

Clinton D. Smith, M. S., Professor of Practical Agriculture and Superintendent of the Farm; [a,b,c] Sept. 1, '93.

Chas. L. Weil, S. B., Professor of Mechanical Engineering and Director of the Mechanical Department; [a,b,c] Sept. 1, '93.

Walter B. Barrows, S. B., Professor of Zoology and Physiology, and Curator of the General Museum; [a,b,c] Feb. 15, '94.

Harry H. Bandholtz, 1st Lieut. 7th Infantry, U. S. Army, Professor of Military Science and Tactics; [a,b,c] Sept. 1, '96.

Frank S. Kedzie, M. S., Adjunct Professor of Chemistry; [a,b] Sept. 15, '80; [c] Jan. 1, '91.

Philip B. Woodworth, B. S., M. E., Assistant Professor of Physics; [a,b] May 22, '87; [c] Aug. 7, '89.

WILLIAM S. HOLDSWORTH, B. S., Assistant Professor of Drawing; [a] Feb. 22, '81; [b] Aug. 22, '87; [c] Jan. 1, '90.

ALVIN B. NOBLE, Ph. B., Assistant Professor of English Literature and Modern Languages; [a b c] Sept. 1, '89.

WILBUR O. HEDRICK, B. S., Assistant Professor of History and Political Economy; [a b] Aug. 24, '91; [c] Sept. 1, '93.

PAUL M. CHAMBERLAIN, M. E., Assistant Professor of Mechanical Engineering; [a b c] Sept. 1, '93; [d] Sept. 1, '96.

WARREN BABCOCK, JR., B. S., Assistant Professor of Mathematics; [a b] June 30, '91; [c] Sept. 1, '93.

HERBERT W. MUMFORD, B. S., Assistant Professor of Agriculture; [a] Sept. '95; [b c] Dec. 1, '96.

GAGER C. DAVIS, M. S., Instructor in Zoology; [a b c] Mar. 1, '93; [d] Jan. 1, '97.

CHARLES F. WHEELER, B. S., Instructor in Botany; [a b] Mar. 1, '90; [c] May 1, '93.

A. L. WESTCOTT, B. M. E., Instructor in Mechanical Engineering; [a b c] June 1, '93.

DICK J. CROSBY, B. S. Instructor in English; [a b c] Sept. 1, '93.

BURTON O. LONGYEAR, Instructor in Botany; [a b c] Feb. 15, '94.

CYRUS C. PASHBY, Instructor in Mathematics; [a b c] Sept. 1, '94.

MERRITT W. FULTON, B. S., Instructor in Agriculture; [a b c] Sept. 15, '95.

GORDON H. TRUE, B. S., Instructor in Dairying; [a b c] Sept. 1, '94.

H. E. SMITH, Instructor in Mechanics; [a b c] Sept. 1, '96.

RUFUS H. PETTIT, B. S. A., Instructor in Zoology, [a b c] Feb. 1, 1897.

MRS. LINDA E. LANDON, Librarian; [a b c] Aug. 24, '91.

THOMAS GUNSON, Foreman of Greenhouse; [a b] April 1, '91; [c] Sept. 1, '91.

THOMAS DURKIN, Foreman of the Horticultural Department; [a b c] Mar. 15, '94.

FRED C. KENNEY, Assistant Secretary; [a b c] Sept. 18, '95.

ERNEST WITTSTOCK, Foreman of the Farm; [a b c] Feb. 2, '93.

C. E. HOYT, Foreman of the Wood Shop; [a b c] Feb. 18, '95.

* V. V. NEWELL, Foreman of the Machine Shop; Feb. 18, '95.

W. S. LEONARD, Foreman of the Machine Shop; [a b c] Sept. 1, '96.

D. B. BALDWIN, Engineer; [a b c] June 1, '96.

CHACE NEWMAN, Clerk for Mechanical Department; [a b c] Dec. 1, '92.

EDWIN S GOOD, Clerk to President; [a b c] July 15, '96.

KENYON L. BUTTERFIELD, B. S., Supt. Institutes and College Field Agent; [a b c] June 1, '95.

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* Resigned Aug. 31, '96.

AGRICULTURAL EXPERIMENT STATION.

OF THE

STATE AGRICULTURAL COLLEGE.

[Under the control of the State Board of Agriculture.]

STATION COUNCIL.

Clinton D. Smith, M. S.,	Director.
Clinton D. Smith, M. S.,	Agriculturist.
L. R. Taft, M. S.,	Horticulturist.
Robt. C. Kedzie, M. A., M. D.,	Chemist.
Ira H. Butterfield,	Sec. and Treas.
J. L. Snyder, Pres.,	*Ex officio* member.

ADVISORY AND ASSISTANT STAFF.

H. W. Mumford, B. S.,	Asst. in Agriculture.
A. A. Crozier, M. S.,	" Agriculture.
H. P. Gladden, B. S.,	" Horticulture.
M. L. Dean,	" Horticulture.
Thorne Smith, B. S.,	" Chemistry.
E. A. A. Grange, V. S.,	Consulting Veterinarian.
W. B. Barrows,	Consulting Zoölogist.
Chas. F. Wheeler, B. S.,	" Botanist.
J. S. Conway,	Clerk to Director.
Mrs. L. E. Landon,	Librarian.
R. L. Taylor,	Apiarist.
C. S. Brooks,	Foreman Poultry Dept.

SUB-STATIONS.

Grayling, Crawford county, 80 acres deeded.

South Haven, Van Buren county, 10 acres rented; 5 acres deeded; Local Agent, T. T. Lyon, President State Horticultural Society.

STATE WEATHER SERVICE.

[Under control of the State Board of Agriculture.]

OFFICERS OF THE SERVICE.

Director, - - - - - C. F. Schneider, U. S. Weather Service, Lansing.

STANDING COMMITTEE IN CHARGE.

Hon. C. J. Monroe, - - - - - - - - - - - - - - South Haven.

Hon. Chas. W. Garfield, - - - - - - - - - - - - - Grand Rapids.

ACCOUNTS OF THE STATE AGRICULTURAL COLLEGE.

FOR THE FISCAL YEAR ENDING JUNE 30, 1897.

SECRETARY'S ACCOUNT.

			Dr.	Cr.
July 1, 1894.	To cash on hand		$1,035 27	
" 1, 1894.	To cash on deposit with college treasurer, less $1,799.80 outstanding warrants		12,980 88	
" 1, 1894.	By balance due students on deposit accounts		....	$3,012 02
" 1, 1894.	To cash on deposit with New York bank		379 24	
June 30, 1895.	To special appropriation receipts, per table No. 2, page 10:			
	From State Treasurer	$13,590 00		
	From United States Treasurer	15,000 00		
	From institution	1,654 66		
			30,244 66	
June 30, 1897.	By special appropriation disbursements, per page 10		....	29,842 36
" 30, 1897.	To current account receipts, per table No. 3 page 11:			
	From State Treasurer	$40,000 00		
	From United States Treasurer	22,000 00		
	From institution	9,267 28		
	From institution on building account	3,944 68		
			75,211 96	
June 30, 1897.	By current account disbursements, per table No. 3 page 11:			
	General current account	$76,648 11		
	Current building account	3,685 38		
				80,333 49
June 30, 1897.	To balance due students on deposits		1,384 45	
" 30, 1897.	To overdrawn on college treasurer		....	2,765 08
" 30, 1897.	To cash, New York bank		36 77	
" 30, 1897.	By cash on hand		....	5,320 28
			$121,273 23	$121,273 23

TABLE NO. 1.—*Tabular exhibit of Secretary's account.*

Name of account.	Balance sheet, July 1, 1896.		Transactions July 1, 1896, to June 30, 1897.		Balance sheet, June 30, 1897.	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.
Cash	$1,414 51	....	$3,869 00	....	$5,283 51	....
† College treasurer	12,980 88	....	....	$10,215 80	2,765 08	....
Students' deposits	....	$3,012 02	1,627 57	....	....	$1,384 45
Special appropriations	....	6,396 51	29,842 36	30,244 66	....	6,798 81
Current building account	....	5,193 57	3,685 38	3,944 68	....	5,452 87
Current general account	206 71	....	76,648 11	71,267 28	5,587 54	....
Totals	$14,602 10	$14,602 10	$115,672 42	$115,672 42	$13,636 13	$13,636 13

* Balance of Dr. and Cr. Transactions.
† Treasurer's statement is greater July 1, 1896, by $1,799 80, and June 30, 1897, by $2,846.95, warrants outstanding.

TREASURER'S ACCOUNT.

	Dr.	Cr.
Balance July 1, 1896	$14,780 68	
Receipts from State Treasurer and Secretary of State Board of Agriculture	98,872 98	
Interest on deposits, 12 months at 3 per cent	371 77	
Warrants paid from July 1, 1896, to June 30, 1897	....	$108,413 40
Balance on hand June 30, 1897	....	5,612 03
	$114,025 43	$114,025 43

B. F. DAVIS, *Treasurer.*

TABLE NO. 2.—*Statement of special appropriation account for fiscal year July 1, 1896 to, June 30, 1897.*

Name of appropriation.	Balance of account July 1, 1896.		Receipts during fiscal year.		Total available.	Total expended.	Balance of account June 30, 1897.		Total calendar years 1897-8.	Balance of appropriation in State Treasury June 30, 1897.
	Dr.	Cr.	From State Treasury.	From Institution.			Dr.	Cr.		
Experiment station	....	$3,081 64	* $15,000 00	$1,502 41	$19,584 05	$16,804 93	....	$2,779 12	$30,000 00	....
Library gallery	....	1 57	....	....	1 57	1 57	....	....	....	....
Weather service	....	20 77	1,250 00	....	1,270 77	1,284 52	$13 75	....	2,000 00	$1,250 00
Closets	....	1,611 05	....	....	1,611 05	1,611 05	....	....	....	....
Repairs and walks	....	41 94	5,000 00	147 62	5,189 56	2,156 12	....	3,033 44	12,000 00	9,000 00
Institute	....	....	5,000 00	4 63	5,004 63	5,004 63	....	....	....	....
Student labor	....	1,639 54	† 2,340 00	....	3,979 54	2,979 54	....	1,000 00	5,000 00	4,000 00
Balance	$6,396 51	....	....	....	....	....	6,798 8.	....	....	....
Total	$6,396 51	$6,396 51	$28,590 00	$1,654 66	$36,641 17	$29,842 36	$6,812 56	$6,812 56	‡ $19,000 00	$13,250 00

* $15,000 from U. S. Treasurer direct.
† $660.00 of the appropriation for 1895-6 remained unexpended and reverted to the State Treasury June 30, 1897.
‡ Two years.

TABLE NO. 3.—*Current account July 1, 1896, to June 30, 1897.*

On account of—	Dr. To disbursements.	Cr. By receipts.
United States Treasurer, seventh annual payment under act of congress of August 30, 1890		$22,000 00
State Treasurer, interest on proceeds of sales of U. S. land grant, see table No. 13, page 18		40,000 00
Students' class fees, per table No. 7		2,340 80
Students' sundry fees, credited to building account, per table No. 7		8,558 34
Salaries paid	$37,634 46	
Farm department, see table No. 5, page 12	5,956 40	3,717 46
Horticultural department, see table No. 6, page 12	3,677 09	1,350 96
Mechanical department	3,002 82	63 78
Heating, lighting and cleaning	13,334 24	907 17
Academic departments	6,564 00	77 33
Offices, postage, stationery, advertising and sundry	6,579 10	809 79
State swamp land grant sale, credited to building account		
Sundry receipts credited to building account		
Interest and exchange, credited to building account		386 34
Building account	3,685 88	
Totals	$80,333 49	$75,211 96
Balance at beginning of period, July 1, 1894		4,986 86
Balance at close of period, June 30, 1895		134 67
Footings	$80,333 49	$80,333 49

TABLE NO. 4.—*Experiment Station account, July 1, 1896, to June 30, 1897.**

On account of—	Dr. To disbursements.	Cr. By receipts.
Balance from last fiscal year		$3,081 64
United States treasurer for fiscal year		15,000 00
Fertilizer license fees and expenses		1,220 00
Salaries	$8,202 58	
Farm department	2,471 06	282 41
Horticultural department	649 37	
Chemical department	449 36	
Botanical department	29 06	
Zoological department	75 65	
Veterinary department	785 31	
Buildings	1,154 85	
Library	157 59	
Offices, etc	404 21	
South Haven station	1,971 10	
Apiary	504 59	
Balance on hand at close of fiscal year	2,779 12	
Totals	$19,584 05	$19,584 05

* For fuller details of this account see the special report of the experiment station in the body of this volume.

TABLE NO. 5.—*Account with Farm Department.*

On account of—	Dr. To disbursements.	Cr. By receipts.
Labor aside from student labor	$2,896 88	....
Farm house	45 89	....
Cattle	349 25	$508 50
Sheep	155 86	236 77
Swine	153 72	407 85
Grain	82 04	284 78
Produce	....	34 34
Implements and repairs	253 48	4 00
Wood	88 90	243 28
Office, etc.	662 80	931 46
Drains	15 90	....
Seeds	150 68	....
Board of farm hands	939 68	....
Team	107 65	....
Dairy	156 25	1,066 48
Fence	53 97	....
Balance	....	2,238 94
Footings	$5,956 40	$5,956 40

TABLE NO. 6.—*Account with Horticultural Department, including greenhouse.*

On account of—	Dr. To disbursements.	Cr. By receipts.
Labor, aside from student labor	$3,018 59	....
Team	112 57	....
Grounds	18 00	....
Freight	52 86	....
Implements and repairs	89 54	....
Seeds and plants	199 39	....
Office, etc.	241 14	....
Sundry receipts and garden products sold	....	$1,350 96
Balance	....	2,326 13
Footings	$3,677 09	$3,677 09

TABLE NO. 7.—*Students' fees.*

On account of—	Current account general.	Current account building.	Total.
Room rent	....	$2,417 59	$2,417 59
Incidental expense fees	$1,912 50	....	1,912 50
Physiological dissection fees	9 50	....	9 50
Veterinary dissection fees	4 50	....	4 50
Chemical analysis fees	386 80	....	386 80
Music	7 50	....	7 50
Physical fees	20 00	....	20 00
Special examination fees	....	54 00	54 00
Matriculation fees	....	675 00	675 00
Diploma fees	....	280 00	280 00
Tuition fees from non-resident students	....	181 75	181 75
Totals	$2,340 80	$3,558 34	$5,899 14

TABLE NO. 8.—*Student labor.—Account of wages paid for twelve months, July 1, 1894, to June 30, 1895.*

On account of—	Student labor.	Experiment station.	Total.
Farm department	$1,585 02	$22 24	$1,607 26
Horticultural department	758 53	....	758 53
Mechanical department, repairs and heating	13 94	....	13 94
Bell ringing, choir, etc.	107 00	....	107 00
Janitor	99 55	....	99 55
Offices	29 51	....	29 51
Veterinary department	50 52	....	50 52
Zoological department	12 06	....	12 06
Botanical department	1 94	....	1 94
Physical department	56 58	....	56 58
M. A. C. Record	62 22	....	62 22
Military department	107 60	....	107 60
Library	30 25	....	30 25
Chemical department	29 58	....	29 58
Lighting	9 00	....	9 00
Totals	$2,957 30	$22 24	$2,979 54

TABLE No. 9.—*Employés and salaries.*

	Paid from.			Total.
	Current account.	Experiment station account.	Other sources.	
President, dwelling and	$3,200 00	....	....	$3,200 00
One professor, dwelling and	1,700 00	$300 00	....	2,000 00
One professor, dwelling and	1,200 00	1,100 00	....	2,300 00
One professor, dwelling and	1,200 00	600 00	....	1,800 00
Five professors, dwelling and	1,800 00	....	....	9,000 00
One professor, dwelling and	1,800 00	....	....	1,800 00
*One professor, dwelling and	....	....	$1,800 00	....
One professor	1,200 00	300 00	....	1,500 00
Five assistant professors, rooms and $1,000 each	5,000 00	....	....	5,000 00
One assistant professor, rooms and $1,000	500 00	500 00	....	1,000 00
One assistant professor, rooms and	900 00	....	....	900 00
One instructor, rooms and	800 00	....	....	800 00
Two instructors	600 00	....	....	1,200 00
Four instructors, rooms and $500 each	2,000 00	....	....	2,000 00
†Secretary, dwelling and	300 00	500 00	1,000 00	1,800 00
Assistant secretary, room and	600 00	....	....	600 00
Librarian, rooms and	505 00	120 00	....	625 00
Foreman of farm, dwelling and	600 00	....	....	600 00
Foreman of garden, room and	500 00	....	....	500 00
Foreman of iron shop	750 00	....	....	750 00
Foreman of wood shop	750 00	....	....	750 00
Florist, dwelling and	800 00	....	....	800 00
One assistant florist	420 00	....	....	420 00
One consulting botanist, rooms and	500 00	500 00	....	1,000 00
One assistant entomologist, room and	500 00	500 00	....	1,000 00
One assistant in experiments, room and	....	500 00	....	500 00
One assistant in experiments, room and	....	800 00	....	800 00
One assistant in experiments, room and	....	600 00	....	600 00
One assistant in experiments, rooms and	....	1,000 00	....	1,000 00
Engineer, dwelling and	600 00	....	....	600 00
Herdsman, board and	420 00	....	....	420 00
One assistant bacteriologist	1,000 00	....	....	1,000 00
Clerk to mechanical department	420 00	....	....	420 00
Clerk to president	500 00	....	....	500 00
College field agent	600 00	....	....	600 00
Totals	$32,265 00	$7,320 00	$2,800 00	‡ $47,885 00

*Army officer detailed as Professor of Military Science and Tactics. Salary paid by U. S. Government.
† $1,000 of salary as Secretary of the Board of Agriculture is paid from the State treasury.
‡ This total represents the rate of salaries and not the amount actually paid out.

TABLE No. 10.—*Agricultural College lands, United States grant of 1862; record of sales and forfeitures to the present time.*

Year.	Original sales.			Forfeited lands resold.			Total sales.			Number of acres reverting by forfeitures.	Aggregate of sales, less forfeitures to end of each year. Acres.	Balance remaining vacant at end of each year. Acres.
	Acres.	Average price per acre.	Amount.	Acres.	Average price per acre.	Amount.	Acres.	Average price per acre.	Amount.			
1867												235,683.46
1868	520.	$5 00	$2,600 00				520.	$5 00	$2,600 00		520.	235,163.46
1869	13,480.	3 19	43,000 00				13,480.	3 19	43,000 00		14,000.	221,683.46
1870	3,280.	3 44	11,280 00				3,280.	3 44	11,280 00		17,280.	218,403.46
1871	9,372.44	3 37	31,637 82				9,372.44	3 37	31,637 82		26,652.44	209,030.02
1872	20,580.25	3 19	65,660 75				20,580.25	3 19	65,660 75		47,232.69	188,449.77
1873	17,205.89	3 15	54,177 67	40.	$3 62	$145 00	17,245.89	3 15	54,322 67	40.	64,438.58	171,243.88
1874	2,039.96	3 20	6,519 75	40.	3 00	120 00	2,079.96	3 19	6,639 75	638.72	65,879.81	169,802.65
1875	4,798.99	3 08	14,796 97	40.	3 00	120 00	4,838.99	3 08	14,916 97	560.	70,158.80	165,528.66
1876	1,953.73	3 12	6,101 19	520.	4 38	2,280 00	2,473.73	3 30	8,381 19	1,758.40	70,874.13	164,808.33
1877	1,634.75	3 00	4,904 25	200.	3 00	600 00	1,834.75	3 00	5,504 25	1,438.06	71,270.82	164,411.64
1878	4,034.80	3 10	12,504 40	1,135.73	3 91	4,443 65	5,170.53	3 28	16,948 05	2,415.73	74,025.63	161,656.84
1879	6,782.12	3 02	20,506 36	1,318.06	3 08	4,054 18	8,100.18	3 03	24,560 54	1,978.11	80,147.69	155,534.77
1880	8,826.56	3 03	26,729 58	280.	3 18	890 00	9,106 56	3 03	27,619 58	4,926.33	84,327.92	151,354.54
1881	6,168.97	3 96	24,447 25	360.	4 33	1,560 00	6,528.97	3 98	26,007 25	1,987.19	88,869.70	146,812.76
1882	10,225.99	5 00	51,129 95	1,637.01	5 09	8,335 05	11,863.00	5 01	59,465 00	760.11	99,972 59	135,709 87
1883	7,035.57	5 00	35,177 85	1,680.	5 03	8,448 00	8,715.57	5 00	43,625 85	560.	108,128.16	127,554.30
1884	1,846.01	5 09	9,390 05	526.45	5 38	2,832 25	2,372.46	5 15	12,222 30	200.	110,300.62	125,381.84
1885	704.88	5 74	4,044 40	119.52	5 67	677 60	824.40	5 73	4,722 00	525.47	110,599.55	125,082.91
1886	720.	5 83	4,200 00	560.	5 78	3,240 00	1,280.	5 81	7,440 00	440.	111,439.55	124,242.91
1887	1,718.27	6 45	11,091 35	320.	5 00	1,600 00	2,038.27	6 23	12,691 35	200.	113,277.82	122,404.64
1888	2,031.18	6 02	12,235 90	160.	5 00	800 00	2,191.18	5 95	13,035 90	640.	114,829.	120,858.46
1889	1,000.28	6 64	6,641 40	40.	5 00	200 00	1,040.28	6 58	6,841 40	120.	115,749.28	* 119,585.86
1890	2,674.70	8 06	21,561 88				2,674.70	8 06	21,561 88	480.	117,943.98	117,391.16
1891	2,614.66	8 26	21,593 02	480.	6 47	3,105 00	3,094.66	7 98	24,698 02	920.	120,118.64	115,216.50
1892										480.	119,638.64	† 115,996 55⅛
1893	13,376.04	7 47	100,960 99	1,605.95	8 53	10,494 75	14,981.99	7 44	111,455 74	360.	134,260.63	‡ 100,909.98⅛
1894	40.	12 50	500 00				40.	12 50	500 00	440.	133,860.63	§ 101,494 01⅛
1895	43.35	5 38	233 50				43.35	5 38	233 35	200.	133,703.98	101,650.665
1896	1,498.10	8 10	12,136 69	440.11	7 94	3,495 55	1,938.21	8 06	15,632 24	160.	135,482.19	99,872.455
1897	2,556.63	7 35	18,791 28	239.47	7 66	1,836 29	2,796.00	7 38	20,627 57	1,040.00	137,238.19	98,116 45
Total	148,724.11		$634,553 75	$11,742.30		$59,277 72	160,506.31		$693,930 92	23,268.12		

* This amount is 347.32 less than it should be; as to which see p. 19 of report for 1889.
† This amount is 300.055 more than accords with the report of 1891; as to which see p. 15 of 1892.
‡ This amount is 464.58 less than accords with the report of 1892; as to which see p. 16 of 1894.
§ This amount is 204.08 more than accords with the report of 1893; as to which see p. 16 of 1895.

TABLE NO. 11.—*Agricultural College lands, United States grant of 1862; record of forfeitures by counties during the fiscal year ending June 30, 1897, and of the number of acres vacant at the beginning and end of the year.*

Counties.	Acres vacant June 30, 1896, as reported by the land office.	Acres reverting by forfeiture during the fiscal year ending June 30, 1897.	Sales during 1897.	Acres vacant June 30, 1897, if columns 1, 2, and 3 are correct.	Acres vacant June 30, 1897, as reported by the land office.	Discrepancy between columns 4 and 5.		Net discrepancy noted on page 15, report 1895, Reprint of table No 11 of 1894.		Total net discrepancy from reports of land office prior to 1889.	
						Shortage.	Excess.	Shortage.	Excess.	Shortage.	Excess.
Alcona	18,525.71			18,525.71	18,525 71			80.		80.	
Alpena	1,000.00		80.	920.00	920.00			40.		80.	
Antrim	2,320.93	760.00	638 96	2,441.97	2,441.97			40.			
Benzie	2,720.00	40.00		2,760.00	2,760 00						
Charlevoix	2,119.43	40.00		2,159.43	2,159.43			10.			
Cheboygan	5,159.81	160.00	80.00	5,239.81	5,239.81				34 86		28.71
Grand Traverse	160.00			160.00	160.00						
Iosco	26,322.27			26,322.27	26,322 27						
Kalkaska	1,118.00			1,118 00	1,118 00			60.		280.	
Manistee	5,018.355		512.49	4,505.865	4,505.86			39.98¼		00.50	
Missaukee	879.64			879.64	879.64						
Montmorency	6,649.50		244.65	6,404.85	6,404.95			80		40.	
Oscoda	13,370.22			13,370.22	13,370.22				88 38		88.28
Otsego	996.58		80.00	916.58	916.58						
Presque Isle	400.00			400.00	400.00				80.		80.
Wexford	13,112.01	40.00	1,160.00	11,992.01	11,992.01			220.		39.80	
Totals	99,872.455	1,040.00	2,796 10	98,116.45	98,116.45			709.985	198.14	828.31	

TABLE NO. 12.—*Agricultural College trust fund.*

Year.	Receipts of State land office on account of principal for Agricultural College lands sold.	Refunded on account of erroneous payments.	Balance transferred to credit of Agricultural College trust funds.	Aggregate to credit of Agricultural College trust fund at close of each fiscal year.
1868	$2,300 00		$2,300 00	$2,300 00
1869	11,865 00		11,865 00	14,165 00
1870	5,895 00		5,895 00	20,060 00
1871	20,101 58		20,101 58	40,161 58
1872	38,621 93	$174 54	38,447 39	78,608 97
1873	23,583 47		29,583 47	103,109 89
1874	4,686 75		4,686 75	107,879 14
1875	5,399 24		5,399 24	113,278 38
1876	5,939 80	390 00	5,549 80	118,827 68
1877	2,337 22		2,337 22	121,164 90
1878	9,619 99		9,619 99	130,784 89
1879	8,590 53		8,590 53	139,375 42
1880	18,762 28		18,762 28	158,137 70
1881	20,341 18	60 00	20,281 18	178,418 88
1882	51,449 27		51,449 27	229,868 15
1883	34,482 28	825 90	33,656 38	263,524 53
1884	13,802 87		13,802 87	272,387 40
1885	12,400 87		12,400 87	284,788 27
1886	16,545 81		16,545 81	301,333 58
1887	26,731 63		26,731 63	328,065 30
1888	18,122 35		18,122 35	346,187 65
1889	11,431 65		11,431 65	357,619 30
1890	15,991 64		15,991 64	373,610 84
1891	21,994 89		21,992 89	395,605 78
1892	5,808 90	180 00	5,628 90	401,234 68
1893	120,468 27		120,468 27	521,702 90
1894	4,235 08		4,235 08	525,937 98
1895	4,626 63		4,626 63	530,564 61
1896	16,714 49		16,714 49	547,279 10
1897	22,672 72		22,672 72	569,951 10

NOTE.—Fifteen thousand dollars of the above fund was invested from 1870 to 1871 in war bounty bonds and held by the College.

3

TABLE NO. 13.—*Agricultural College interest fund.*

Year.	Interest on Agricultural College fund at 7 per cent, paid by State Treasurer from specific tax fund.	Interest from purchasers on balances due on certificates for part-paid land less refundings and expenses for appraisals, etc.†	Receipts for penalty.	Trespass collections.	Total accrued to credit of Agricultural College each year.	Amount paid over to treasurer of Agricultural College.	Balance remaining to credit of Agricultural College interest fund at close of each fiscal year.
1869	....	$56 68	$2 28	....	$58 96	....	$58 96
1870	*$874 95	1,789 56	56 42	....	2,720 93	$2,779 89	....
1871	§ 1,397 97	2,317 24	70 63	....	3,785 84	2,976 00	809 84
1872	3,953 17	3,099 51	122 97	....	7,175 65	6,774 47	1,211 12
1873	6,040 33	4,907 77	110 96	....	11,059 06	12,238 48	31 60
1874	7,407 65	6,499 21	155 12	......	14,061 98	11,896 00	3,197 58
1875	7,717 24	6,552 93	125 97	$50 00	14,446 14	14,656 00	1,987 72
1876	8,124 31	6,692 47	306 64	1,706 75	16,830 17	18,317 89	....
1877	8,396 64	5,726 58	189 64	860 00	15,172 86	15,172 86	....
1878	8,740 62	6,405 26	247 21	414 00	15,807 09	13,320 61	2,486 48
1879	9,409 73	6,664 80	276 55	627 14	16,978 22	16,602 02	3,362 68
1880	10,240 28	7,333 23	148 73	115 00	17,837 24	17,799 15	2,900 77
1881	11,426 93	8,642 08	285 47	580 77	20,935 25	20,451 85	3,384 17
1882	13,957 04	8,345 45	204 96	....	22,507 45	25,391 62	....
1883	16,741 38	9,141 30	206 96	4,659 96	30,749 60	26,139 13	4,610 47
1884	18,739 02	8,881 98	237 56	51 16	27,909 72	27,402 94	5,117 25
1885	19,645 33	9,121 14	329 06	674 87	29,770 40	29,599 97	5,287 68
1886	20,571 65	9,323 98	565 41	....	30,461 04	29,920 68	5,828 04
1887‡	16,493 98	7,577 57	309 84	229 98	24,611 37	19,761 06	10,678 35
1888	23,425 64	7,310 84	394 85	1,275 27	32,406 60	32,006 10	11,078 85
1889	24,551 32	6,326 39	320 23	124 75	31,322 69	31,988 12	10,613 42
1890	25,653 31	6,490 27	387 25	20 00	32,360 64	32,328 79	10,645 27
1891	27,197 89	6,690 99	348 22	513 44	34,750 54	26,516 92	18,878 89
1892	27,892 14	6,639 20	316 78	100 00	34,948 12	26,153 78	27,673 23
1893	31,464 01	6,107 32	315 71	40 00	37,927 04	51,000 34	13,999 98
1894	36,657 47	5,638 31	365 08	1,866 40	44,527 26	34,120 58	24,406 61
1895	36,871 28	5,125 19	305 08	3,139 40	45,440 95	30,000 00	†39,708 46
1896	37,625 50	4,954 60	340 30	966 00	44,087 25	50,000 00	33,594 88
1897	39,009 06	4,817 00	....	54 09	43,779 54	40,000 00	37,374 40

* This amount was interest on war bounty bonds in which the fund was invested at the time.

§ $525 of this was interest on war bounty bonds in which the fund was invested part of the year.

† Appraisal expenses amounted to $1,726.32, ranging from nothing in 1872 to $208.94 in 1886. Advertising amounted to $1,205.20, ranging from nothing in 1870 to $218.35 in 1884. Trespass examination amounted to $4.00 in 1883. Advertising in 1895 amounted to $42.60 and supervisors appraisals to $96.50, which is deducted to make the balance.

‡ Advertising and appraisals in 1897 amounted to $101.21 which is deducted to make the balance.

SUMMARY OF INVENTORY, JUNE 30, 1897.

College farm and park, 676 acres @ $70		$47,320 00
Buildings—		
Library and museum, built 1881	$25,000 00	
College hall " 1856	20,000 00	
Williams " " 1869	40,000 00	
Wells " " 1877	25,000 00	
Abbot " " 1888, add. in 1896	15,000 00	
Chemical laboratory, " 1871 south end added '81,	18,000 00	
Machine shops and foundry, 1885 south end added '87,	12,300 00	
Veterinary laboratory, built 1885	5,400 00	
Horticultural " " 1888	6,000 00	
Agricultural " " 1889	8,000 00	
Botanical " " 1892	10,000 00	
Armory " 1885	6,000 00	
Greenhouse and stable " 1873, 1879; rebuilt 1892	6,331 55	
Greenhouse, experiment " 1889	1,500 00	
Boiler house and chimney 1893–4	5,000 00	
President's and two frame dwellings, built 1874	15,000 00	
Four brick dwellings, built 1857	12,500 00	
Station apartment dwellings, built 1892	3,500 00	
Two brick " " 1879 and 1884	7,000 00	
One frame dwelling " 1885	4 000 00	
Howard terrace " " 1888	14,500 00	
Farm house " " 1869	3,500 00	
Herdsman's " " 1867	400 00	
Ten barns at professors' houses	2,500 00	
Horticultural barn and shed, built 1858, 1875, 1887	1,500 00	
Cattle barn and shed " 1862	8,500 00	
Sheep " " 1865	2,000 00	
Horse " " 1871	2,500 00	
Pig " " 1871	2,000 00	
Corn " " 1878	500 00	
Grain " " 1881	1,600 00	
Horse sheds " 1894	350 00	
Tool barn built 1881	1,300 00	
Feed " " 1884	1,200 00	
Brick work shop, built 1857	600 00	
Observatory " 1880	150 00	
Bath house and fittings, built 1889	600 00	
Ice house, 1879	200 00	
Bee houses, 1874, $50.00; 1887, $700.00	750 00	
Hospital, 1894	3,500 00	
Poultry building, 1894	575 00	
Poultry yards, 1895	250 00	
Storage barn, 1896	800 00	
Closets in Abbot, Wells and Williams halls	3,000 00	
		293,306 55
Iron bridge over Cedar river, built 1888		1,000 00
Water works and steam works—		
Artesian well and connections, sunk in 1887, 348 ft. deep	$1,000 00	
Fire pump, 1883, $670.00; tank pump, 1881, $180.00	850 00	
700 feet fire hose, 2½ in., bought 1883–88	300 00	
Two hose carts and 4 nozzles, bought 1883–88	99 00	
2,378 ft. wood pipe, 6 in., laid 1883–87	776 00	
2,623 " " " 4 " " 1883–87	640 00	
662 " " " 3 " " 1883–87	115 00	
Water tank and heater, built 1883	518 00	
Thirteen fire hydrants in place, built 1883–87	460 00	
Valves, fittings and connections, laid 1883–87	650 00	
		5,408 00
Carried forward		$347,034 55

Brought forward		$347,034 55
Water works and steam works—*Continued:*		
Four boilers, 4 ft. x 12 ft., built 1881	$844 00	
Two boilers, 5 ft. x 12 ft., built 1887	1,080 00	
Two small pumps, 1884–91	288 00	
Underground steam piping, laid 1882	1,315 00	
Miscellaneous tools and stock	715 68	
One water purifier	352 00	
Water meter	25 00	
Injector	22 00	
Main steam pipe, 1892	155 00	
Safety valve on water main	10 00	
One pile hammer	10 00	
Six service boxes, in place 1893	8 10	
Six lawn hydrants, in place 1894	16 00	
Five-inch exhaust head	15 00	
		4,855 73
Farm Department—		
Cattle, 40 head	$2,525 00	
Sheep, 95 "	856 50	
Horses, 7 "	700 00	
Swine, 89 "	325 00	
Class room, office and farm house equipped	2,691 91	
Tools, implements, scales, windmills, etc.	2,035 61	
Experiment station	1,971 70	
Growing crops, estimated	1,111 75	
Dairy room	501 50	
		12,718 97
Horticultural Department—		
Teams, harness, etc.	$382 25	
Heavy tools	425 20	
Compost and manures	150 00	
Small tools	70 20	
Students' tools	299 20	
Office and other rooms	128 75	
Class room	952 50	
Greenhouse plants	2,412 99	
Vegetable garden	86 50	
Miscellaneous	96 10	
Experiment station	1,052 25	
Greenhouse tools	293 25	
		6,344 19
Mechanical Department—		
Class room and office equipment	$4,430 26	
Machine shop	10,030 57	
Wood shop	2,406 03	
Blacksmith shop and foundry	1,891 92	
		18,767 78
Chemical Department—		
Furniture, apparatus and chemicals	$10,538 41	
Experiment station	2,036 44	
		12,574 85
Physical Department—		
Light	$2,057 05	
Electricity	3,267 15	
Sound	315 10	
Mechanics and fixtures	2,185 12	
Heat	452 25	
		8,276 67
Carried forward		$410,572 74

Brought forward		$410,572 74
Botanical Department—		
Herbarium	$4,999 82	
Museum	900 75	
Office and class apparatus	2,892 65	
Experiment station	448 11	
		9,241 33
Mathematical and Engineering Department—		
Surveying instruments	$2,000 94	
Telescope and accessories	840 25	
Furniture, apparatus, etc	886 87	
Photographic material	52 85	
Office furniture	239 07	
		3,969 98
Library, exclusive of experiment station library—		
19,212 books and pamphlets	$38,524 00	
250 Sunday school books	200 00	
Portraits and pictures	853 00	
Furniture	961 10	
Experiment station library	3,597 60	
		44,135 70
Veterinary laboratory—Museum furniture and apparatus	$3,955 64	
Zoological Department—Furniture and apparatus	2,046 00	
General Museum—Collections and cases	17,150 50	
College hall furniture and English department	953 04	
Drawing	769 10	
Photographic apparatus and material	266 00	
Public parlor furniture, $191.86; hospital furniture, $20.75	212 61	
Club boarding association, 15 shares stock	300 00	
President's office	634 95	
Secretary's office	1,703 50	
Weather service	1,937 60	
Armory, furniture and equipment	724 30	
Abbot hall—Furniture and fixtures	936 97	
State Board of Agriculture rooms	341 69	
Farmers' institute	264 15	
		32,196 05
		$500,115 80
United States property held in trust—		
Two 3-in. rifled guns and equipments	$1,573 55	
150 Springfield rifles, complete	2,250 00	
150 rifle equipments	399 00	
Reloading tools, chests, tarpaulins, etc	288 69	
		$4,511 24

SUMMARY OF EXPERIMENT STATION INVENTORY.

Lands donated to the Station—		
80 acres at Grayling, fenced and improved at cost	$1,850 00	
5 acres at South Haven, fenced and improved	1,000 00	
		$2,850 00
Buildings—		
Experiment feed barn	$1,200 00	
Horticultural laboratory, experimental rooms	1,200 00	
Veterinary laboratory, experimental rooms	250 00	
Apiary	600 00	
Forcing house	1,500 00	
Feed mill	100 00	
Sub faculty building	3,500 00	
Seed room	980 00	
Poultry house and yards	450 00	
Dairy room in agricultural laboratory	250 00	
Small poultry house and yards	250 00	
Storage barn	800 00	
		11,080 00
Library and offices of director and secretary—		
1,701 books	$3,597 60	
Furniture and mailing list in type	457 00	
		4,054 60
Farm Department—		
Office and seed room	$478 25	
Experimental barn and piggery	90 60	
Tool and station barn	253 90	
Poultry	323 60	
Dairy room	81 50	
Growing crops	110 00	
Stock	440 00	
Apiary	193 85	
		1,971 70
Horticultural department—		
Office, furniture, implements, etc.	$837 25	
One team	215 00	
		1,052 25
Chemical department—		
Platinum ware	$210 00	
Glassware	457 74	
Furniture and fixtures	149 50	
Miscellaneous	123 55	
Chemicals	42 30	
Instruments, balances and weights	1,053 85	
		2,036 44
Botanical department—		
Microscopes and accessories	$306 00	
Furniture and sundry apparatus	142 11	
		448 11
Veterinary department—		
Instruments and sundry apparatus		1,450 31
Zoölogical department—		
Microscopes, cases, etc.		734 00
		$25,677 41

TABLE No. 14.—*Detailed statement of Legislative appropriations to the State Agricultural College.*

Object.	Total.	1897.	1895.	1893.	1891.	1889.	1887.	1885.	1883.	1881.	1879.	1877.	1855-75.
Buildings	$234,325 00	Electric light plant .. $5,000 Bath room Abbot hall 200 $5,200 00	Closets $3,000 $3,000 00	Equip. botanical lab..$1,000 Foundry .... 1,500 Hospital 2,500 $5,000 00	Botanical labt'y.....$10,000 Heating apparatus.. 1,950 Greenhouse 4,500 $16,450 00	Agricultural labt'y...$8,000 Sundry 1,800 $9,800 00	Howard terrace.....$10,000 Abbot hall .... 10,000 Horticultural labt'y. 5,000 Mechanical labt'y... 3,000 Bridge, etc. 2,100 $30,100 00	Mechanical labt'y....$7,800 Veterinary labt'y..... 5,400 Armory .... 5,000 One dwelling 4,000 $22,200 00	Boiler house..........$5,000 One dwelling 3,000 $8,000 00	Library ....$25,000 Chemical labt'y add. 6,000 Barns 2,775 $33,775 00	Botanical laboratory..$6,000 One dwelling 3,000 $9,000 00	Wells' hall..........$25,000 $25,000 00	Williams hall, 1869..$30,000 Chemical labt'y, 1871 10,000 Greenhouse, 1873...... 8,000 Three dwellings...... 18,000 Bridges 800 $66,800 00
General account	466,211 48	....	....	....	....	....	....	....	16,770 00	14,498 00	9,943 61	12,800 00	413,143 97
Repairs	77,428 60	12,000 00	12,000 00	13,500 00	7,800 00	5,000 00	1,400 00	3,147 00	6,720 00	1,576 00	1,290 00	8,691 60	9,261 00
Library	25,055 00	....	....	2,000 00	2,000 00	3,000 00	3,000 00	3,300 00	3,125 00	3,000 00	2,000 00	1,190 00	2,440 00
Farm	27,075 64	....	....	900 00	2,100 00	800 00	2,815 00	4,810 00	3,389 00	4,175 00	4,016 64	2,400 00	1,670 00
Garden	12,041 00	....	....	200 00	570 00	500 00	1,250 00	432 00	1,342 00	3,220 00	2,810 00	947 00	720 00
Greenhouse	2,765 00	....	....	....	530 00	600 00	340 00	1,295 00	....	....	....	....	....
Botany	5,331 00	....	....	....	500 00	1,000 00	800 00	800 00	2,231 00	....	....	....	....
Chemistry	13,955 00	....	....	....	500 00	1,500 00	2,000 00	2,500 00	1,000 00	3,000 00	1,000 00	1,380 00	1,075 00
Zoology	10,296 00	....	....	225 00	700 00	1,500 00	1,500 00	1,500 00	1,945 00	1,000 00	800 00	480 00	646 00
Veterinary	2,586 00	....	....	....	100 00	200 00	200 00	2,086 00	....	....	....	....	....
Mathematics	6,190 00	....	....	500 00	200 00	475 00	600 00	450 00	700 00	2,020 00	1,020 00	125 00	....
Mechanical	15,200 00	....	....	....	1,500 00	3,200 00	4,000 00	5,200 00	1,000 00	300 00	....	....	....
Steam and water	20,832 00	....	....	....	2,045 00	2,920 00	7,500 00	1,400 00	4,267 00	....	....	....	2,700 00
Institutes	20,800 00	11,000 00	10,000 00	4,000 00	1,500 00	800 00	600 00	600 00	600 00	600 00	600 00	500 00	....
Student labor	53,000 00	5,000 00	5,000 00	8,000 00	8,000 00	8,000 00	8,000 00	8,000 00	....	....	....	....	....
Weather service	19,937 50	2,000 00	2,000 00	....	....	3,350 00	3,587 50	....	....	....	....	....	....
Sundry	8,960 00	....	....	3,400 00	1,400 00	500 00	2,100 00	....	....	....	600 00	660 00	300 00
Totals	$1,007,899 22	$35,200 00	$35,000 00	$37,725 00	$45,895 00	$48,145 00	$74,793 50	$57,720 00	$51,089 00	$67,164 00	$33,080 24	$48,673 60	$198,858 97
Annual tax on each $1,000 of assessment.	†$0.488	$.0155	$.0155	$.01⅜	$.02	$.02⅜	$.04	$.03⅜	$.03 1-7	$.04 1-7	$.02⅛	$.04	$.0747
* Aggregate tax to date on each $1,000 of assessment.	....	$2.0989	$2.0679	$2.0869	$2.0036	$1.963	$1.912	$1.833	$1.7657	$1.7026	$1.6197	$1.5672	$1.4407
Assessed valuation of State in millions of dollars	....	1106.10	1,130	1,130	1,130	945.45	945.45	810	810	810	630	630	137 to 630

* Counting only taxes actually levied and omitting land grants. † Average.

TABLE No. 15—*Income of the State Agricultural College from all outside sources from the date of its foundation to the present time.*

Year.	From State legislature. For current expenses.	From State legislature. For special purposes.	From State legislature. Land sales, salt spring and swamp land grants	From U. S. Congress. Morrill act of 1862, interest from land grant.	From U. S. Congress. Hatch act of 1887, experiment station.	From U. S. Congress. Morrill act of 1890, supplementary endowment.	Total.
1855			$56,320 00				$56,320 00
1856							
1857	$40,000 00						40,000 00
1858							
1859	87,500 00						87,500 00
1860							
1861	6,500 00		152 25				6,652 25
1862	10,000 00		218 97				10,218 97
1863	9,000 00		407 80				9,407 80
1864	9,000 00		726 09				9,726 09
1865	15,000 00		1,156 61				16,156 61
1866	15,000 00		1,094 27				16,094 27
1867	20,000 00		7,608 88				27,608 88
1868	20,000 00		592 49				20,592 49
1869	20,000 00	$30,000 00	17,559 00	$58 96			67,617 96
1870	20,000 00		1,320 02	2,720 93			24,040 95
1871	18,250 00	10,500 00	4,135 72	3,785 84			36,671 56
1872	18,250 00	8,000 00	217 05	7,175 65			28,642 70
1873	21,796 00	15,6 2 00	10 13	11,059 06			48,467 19
1874	18,000 00	15,602 00	150 13	14,061 98			42,814 11
1875	7,638 00	7,755 50	144 53	14,446 14			29,984 17
1876	7,638 00	6,755 50	1,778 09	16,830 17			32,996 76
1877	6,150 00	30,686 80	979 06	15,172 86			52,988 72
1878	6,150 00	5,686 80	826 60	15,807 09			28,470 49
1879	4,971 80	16,068 32	712 22	16,978 23			38,730 56
1880	4,971 80	7,063 32	797 55	17,837 24			30,674 91
1881	7,249 00	43,720 50	461 95	20,935 25			72,366 70
1882	7,249 00	8,945 50	358 46	22,507 45			39,060 41
1883	8,385 00	23,793 00	391 95	30,749 60			63,319 55
1884	8,385 00	10,526 00	1,259 90	27,909 72			48,080 62
1885		35,103 00	187 50	29,770 40			65,060 90
1886		22,617 00		30,461 04			53,078 04
1887		* 44,040 00	† 198 20	† 24,611 37			68,849 57
1888		30,752 50	444 20	32,406 60	$15,000 00		78,603 30
1889		* 20,973 00	10 50	31,322 69	15,000 00		67,306 19
1890		* 27,172 00	238 50	32,360 64	15,000 00	$15,000 00	89,771 14
1891		22,947 50	37 38	34,750 54	15,000 00	16,000 00	88,735 42
1892		22,947 50	187 38	34,948 12	15,000 00	17,000 00	90,083 00
1893		18,862 50	10 50	37,927 04	15,000 00	18,000 00	87,800 04
1894		18,862 50	433 59	41,527 26	15,000 00	19,000 00	95,823 35
1895		‡ 19,000 00	10 50	45,301 85	15,000 00	20,000 00	99,312 35
1896		‡ 16,000 00		44,037 25	15,000 00	21,000 00	96,037 25
1897		¶ 17,700 00		43,779 54	15,000 00	22,000 00	98,479 54
Totals	$363,183 60	$548,687 74	$101,082 47	$704,240 50	$150,000 00	$146,000 00	$2,014,093 96

* Including appropriations for weather service.
† Oct. 1, 1886, to June 30, 1887, nine months.
‡ Including $3,000 for institutes and $1,000 for weather service.
¶ Including $5,500 for institutes and $1,000 for weather service.

A SUMMARY OF THE RESOURCES OF THE STATE AGRICULTURAL COLLEGE.

Farm, buildings and equipments, as per inventory on pp. 21–22	$500,115 80
Agricultural College trust fund, from sale of lands of United States grant	569,951 10
Balance due on purchase money " " " " " " " "	70,841 75
98,116.45 acres @ $5 per acre as yet unsold " " " " " "	490,582 25
320 acres @ $4 per acre yet unsold of swamp land grant	1,600 00
Total	$1,632,590 90

The 98,116.45 acres yet vacant of the U. S. land grant are given in detail as located in the different counties in table No. 11, p. 16.

The 320 acres of swamp land is what still remains unsold of a grant from the State to the college of swamp lands located in the township of Bath, in Clinton county.

The present amount of the trust fund is taken from the last line of the fifth column of table No. 12, p. 17.

The balance due on purchase money is reported by the Commissioner of the State Land Office, and consists of the total amount for which the College lands have been sold up to the present time, *i. e.*:

The total of the fourth column from the right in table No. 10, p. 15	$693,930 92
Less the payments made on these sales, constituting the trust fund	569,951 10
	$123,979 82
And less balances unpaid on abandoned descriptions which have reverted to the State by forfeiture for non-payment of interest, as shown in the third column from the right, in table No. 10, page 15	53,638 07
	$70,841 75

DEPARTMENT REPORTS.

REPORT OF THE PRESIDENT.

To the Honorable the State Board of Agriculture:

I herewith tender my report, as President of the College under your control, for the year ending June 30, 1897.

As I assumed the duties of my present position in March, 1896, my report for last year was necessarily very brief.

Soon after taking charge of the College three very important and somewhat radical changes were made in the policy of the institution, namely: the long winter vacation was changed from the winter to the summer months. A course for young women was outlined and adopted and Abbot Hall set apart for their exclusive use; it was decided to offer four special six-week courses during the winter. These changes had been under consideration for several years and seemed to meet the approval of the faculty, as well as many influential citizens of the State.

During the early history of the College students taught school during the winter vacation and thereby earned almost enough money to carry them through the school year. It was believed also that practical agriculture could be studied to better advantage during the summer months than during the winter. This plan seems to have been well suited to the conditions prevailing at that time, but at the present time very few schools have short winter terms and in recent years only comparatively few of the students have found it convenient or profitable to teach during the winter vacation. It is believed, also, that students returning to the farm during the long vacation will be kept in closer touch with agriculture and will be more likely to return to industrial pursuits after graduating. The experience of the first year testifies to the wisdom of this change. It has not resulted in students dropping out to teach or leaving college for the lack of funds. Only one student during the last year got leave of absence to teach during the winter. It is believed that this change will result in great good to the College.

It has been urged for a number of years that the College should offer to young women the same advantages that it has offered in the past to young men. It has been believed by many that what science has done for the farm and shop it can do for the home. With this in mind, a course of study for young women, covering four years of work, has been outlined and adopted. It affords an opportunity to acquire a thorough knowledge

of English, mathematics, history, literature, French, German, botany, chemistry, entomology, natural philosophy; but the distinguishing feature of the course is the emphasis it lays on home making. There is given, in addition to other studies, in the freshman year a very full course in cooking. The object of this instruction is to familiarize students with the most healthful, attractive, and at the same time economical methods of preparing such articles of food as are found on a well appointed table. A course of lectures in Domestic Science is given during the sophomore year. Students during this year also spend four hours per week in the sewing room. A thorough course is given in plain sewing, cutting and fitting. Millinery is given as an elective during the junior year. While the practical work has been emphasized, it has not been the intention to despise what are called accomplishments. A thorough course in drawing; a course of lectures in the graphic arts; a course of lectures in the history of art with illustrations, and elective work in painting, are given. Two years of instruction on the piano, free of charge, are offered to young women who are pursuing the regular women's course and not deficient in more than two studies. There is a chorus class free to all who may desire such instruction. This meets one hour each week for practice. In addition to the three regular studies during the junior and senior years, young women elect work in one of the following courses: Floriculture, fruit culture, kitchen gardening, millinery, invalid cooking, dairying, poultry raising. This course is put on precisely the same footing as the other course and the graduate is given the degree of Bachelor of Science. About forty-five young women entered upon this course at the beginning of the year, and the indications are that it will become very popular and attract many students.

The College, in its endeavor to keep in close touch with the agricultural interests of the State, has deemed it wise to offer to that class of farmers, both old and young, who cannot avail themselves of our long four year course, the advantage of special winter courses. Eighteen took the special six weeks course in dairying, fifteen live stock husbandry, ten fruit culture and two floriculture and one vegetable gardening. They entered into the work with enthusiasm and expressed great satisfaction with the results. It is believed that these special courses will be very much appreciated by the farmers of the State. All these changes have met the highest expectations of those who are responsible for the progress of the College.

The attendance during the year was fairly good. There were enrolled during the year 342 regular students, 11 graduate students, and 45 in the special courses, making a total of 398. There was graduated in the class of '97 the following, with the degree of Bachelor of Science: Amos, Walter G.; Cartland, Albert T.; Champion, Sadie D.; Dibble, Henry A.; Eastman, George N.; Elliott, James A.; Fulton, Sanford H.; Goodwin, William R.; Green, Edward C.; Hart, Herbert W.; Herrman, Charles F.; Howland, William S.; Laitner, Cass B.; McLouth, J. DeWitt; Munson, Lewis S.; Parker, George A.; Redfern, Scott J.; Rigterink, John W.; Robinson, Ernest A.; Sanderson, E. Dwight; Sedgwick, Earl H.; Shaw, Elwood; Simmons, Irving L.; Sobennikoff, Vadim; VanNorman, Herbert E.; Vaughn, Amy B.; Brown, Albert E.; Lewis, Fred W.

Master of Science, Charles P. Close, '95.

The honorary degree of Doctor of Science was conferred upon W. W. Daniels, '64, Professor of Chemistry in the University of Wisconsin.

The general condition of the College is good and the future prospects of the institution are bright. The best of feeling has prevailed in the Faculty, and all seem determined to make the College meet the highest expectation of its friends.

Very respectfully,
J. L. SNYDER.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1897.

DEPARTMENT OF PRACTICAL AGRICULTURE.

REPORT FOR THE YEAR ENDING JUNE 30, 1897.

To the President:

SIR—I have the honor to submit herewith the annual report of the Department of Practical Agriculture, for the year ending June 30, 1897.

C. D. SMITH.

CLASS INSTRUCTION.

No change in the personnel of the teaching force of this Department has taken place within the year, except that the Board, at the request of the head of the Department, promoted Instructor H. W. Mumford to the Assistant Professorship. The division of work has been so made that the time of each instructor could be devoted to some special line, as far as the general work of the Department would permit. The instruction in live stock, the history of breeds, principles and methods of breeding, stock judging and general management of the flocks and herds, has been given by H. W. Mumford. A. A. Crozier, while nominally connected alone with the Experiment Station, has had the class work relating to field crops. The immediate supervision of the student labor and the laboratory work with soils has been placed in the hands of M. W. Fulton. He has also devoted a large part of his time to the study of fences, farm machinery and dynamometrical tests. G. H. True has given the instruction in dairy work both to the students in the regular course and to the special students in the winter. To Clinton D. Smith has fallen the lectures and other instruction in stock feeding to the regular and special students, the general management of the student labor, the class-room work in soils during the summer term of 1897, the lectures in senior agriculture, the lectures and recitations in farm managements and accounts and the general management of the farm. C. S. Brooks, in charge of the poultry division of the Experiment Station, taught the sophomores and freshmen the principles of judging and managing poultry.

For the first time the long vacation has been moved from the winter to the summer, and I have to report the effect of the change on the work of this Department. By reason of this change this report will cover the work of four terms, namely, the closing term of the College year ending in August, 1896, as well as the three terms of the present College year.

In the term ending in August, 1896, Mr. Crozier completed the lectures on farm crops with the class of 1897, and on soils to the same class. Lecture work without accompanying laboratory work on these two subjects is not satisfactory. No student can get more than the history of the crops and a knowledge of the underlying principles which govern their production from a set of lectures. The matters relating to their cultivation and harvesting must be taught in the fields. For this reason, and because a study of the mechanical composition and properties of soil require no previous scientific training, the freshman class took up the subject in the laboratory in the first term of their course. The students were given a sample of soil, of which they made a mechanical analysis according to the methods recommended by Prof. Milton Whitney, of the Department of Agriculture at Washington, to whom this Department is indebted for many valuable suggestions in planning this phase of the work. An examination of a variety of soils followed until an acquaintance was made with the physical characteristics of our most common kinds. This in turn was followed by a study of the adaptability of these different sorts of soils to the crops usually grown on Michigan farms and the methods of culture that should be recommended.

The interest of the students was aroused at the beginning and continued unabated to the end of the term. The importance of the subject was recognized, and the practical value of the knowledge gained has been apparent in the later field work of the course.

In the fall of 1896 the agricultural students in the class of 1898 brought to successful conclusion many experiments with field crops. This work was in addition to the detailed study of the various methods of planting, cultivating and harvesting the cereals and forage crops grown on the College farm. At least one afternoon of each week was spent in observing and considering the noteworthy events that had transpired within the preceding two days. Mimeograph notes were furnished, directing attention in a general way to the localities to be visited, and awakening interest, but leaving to the powers of observation of the student the detection of the specific points to be noted. A simple performance of the work connected with growing a crop, without a frequent intelligent survey of the relation of that work to the success of the crop as a whole on the one side, and to the general farm work on the other, is but empiricism. To farther cultivate the executive ability and to give a clear insight into the management of the farm as a commercial venture, as well as to give experience in the thoughtful consideration of passing events and planning for future work, each student was sent out alone over the farm and required to name in order the work he would have performed were he in charge. On his return his report was read and criticised by the instructor and class.

I am glad to report that the work in live stock is increasing in efficiency. The subject never fails to be interesting to the student, and the growth in power of observation and in maturity of judgment is so rapid that

the hours spent in this study are a pleasure as well as a matter of great value. The change in the schedule whereby the freshman class could be divided into two sections, each taking this live stock work for two hours in the forenoon for the first ten weeks of the term, made it possible for the teacher to meet a smaller number of students at one time than heretofore and to carry on the work more satisfactorily for that reason. Excellent as is the equipment of the College in this direction, the need is felt of representative specimens of still other breeds of both sheep and cattle.

INSTITUTE WORK.

The change of the long vacation from winter to summer renders it difficult for members of the Faculty to attend the Institutes without neglecting the class work. On the other hand, to keep in touch with the lives and experiences of practical farmers it is absolutely necessary that those teachers that have to do with the instruction in practical farm work should attend these meetings and become acquainted with the thought of the people. By so planning affairs that but two instructors were gone at a time from the Department, attendance at Institutes was made possible as follows:

C. D. Smith at Hastings, Niles, St. Louis, Brooklyn, Grand Rapids and Flushing.

H. W. Mumford at Midland, Roscommon, Grayling, Mio and St. Louis.

A. A. Crozier at Harrisville, Allegan, Alpena, Coldwater, Albion, St. Louis, Tawas City, Muskegon, Fremont, Holland and Morley.

G. H. True at Hastings, Benzonia, St. Louis, Copemish, Midland, Lake City, Rose City and Sherman.

M. W. Fulton at Allegan, Holland, Fremont, Muskegon, St. John, Carson City, Mt. Pleasant, St. Louis, Morley, Adrian and Hillsdale.

THE SPECIAL COURSES.

As announced in the catalogue the special courses began on the 4th of January, 1897, and continued six weeks. Seventeen students attended the course in dairy husbandry and fourteen that of live stock. For the former course equipment was provided for instruction along the line of home dairy work only and no attempt was made, therefore, to train the men either in cheese making or factory work of any kind. The milk of the College herd was supplemented by purchase in amounts varying from eight to nine hundred pounds daily. The De Laval, United States, Sharpless and Mikado hand separators were in daily use. Part of the milk was set in either the Crystal creamery, made at Lansing, the Wilson creamery, made at Flint, Mich., or plain shot gun cans in a tank of ice water, in order that the students might become thoroughly familiar with all the details of cold deep setting, as well as the management of the separator. In the cream ripening and for churning and handling the butter, utensils were used similar to those which the dairyman, with a small herd of cows, would use on his farm. Very satisfactory progress was made in this phase of the work and the young men in attendance

left the college fully competent to make butter under conditions obtaining in the home dairy. After the close of the course, many applications for men to manage creameries and cheese factories were received. These places we could not of course fill, because the students had not been accustomed to steam machinery.

I very strongly recommend, therefore, that in the special course in dairy husbandry next season, provision be made for instruction in factory work, both in cheese and butter making. Notwithstanding the unfortunate experience of many Michigan communities with butter and cheese factories, it is evident from the history of other states, as well as of certain parts of Michigan, that progress in the dairy is the accompaniment of the establishment of butter and cheese factories. As long as the butter is largely made in private families, just so long will the State not be a leader in dairy matters. A uniform product can not be expected from such a system of manufacture. It seems the plain duty of the College to aid in the change of method of manufacture by educating men competent to manage factories successfully. A separate building suitable to this special purpose is urgently needed, but in its default the present rooms might be enlarged and used until a better equipment is forthcoming.

The instruction given the special students in both the dairy and live stock courses, in the chemistry, botany and veterinary departments, was most eminently satisfactory, and contributed very largely to the value of the courses to the young men attending.

In the special course in live stock husbandry the emphasis was laid on stock judging and the management of flocks and herds. By lectures, and work in the barn, the students were made familiar with many of the details of the successful breeding, feeding and management of cattle, sheep and swine.

COLLEGE HERD.

The tuberculin test was first applied to the animals of the herd in March, 1896, and again in August of the same year. All animals reacting were at once removed from the barns and kept entirely isolated from the cattle barns and their occupants. The barns were then thoroughly disinfected, under the supervision of the veterinary department. Notwithstanding these precautions, however, the application of the test in April, 1897, revealed the presence of tuberculosis in several of the best animals in the herd, including the famous cows Belle Sarcastic and College Pogis.

Excluding the tuberculous animals, now kept isolated for experimental purposes, there is upon the farm at the date of this report 40 head of thoroughbred animals, distributed among the different breeds as follows: Shorthorns, 8; Galloway, 1; Red Polled, 2; Holsteins, 14; Jerseys, 8; Brown Swiss, 4; Grades, 3.

The herd of swine includes 13 Duroc Jerseys, 17 Poland Chinas and 9 Chester Whites.

The flock of sheep is composed of 57 Shropshires, 10 Hampshires, 6 Oxfordshires, 7 Horned Dorsets, 3 Cotswolds, 1 Leicester, 4 American Merinos, 2 National Merinos, 1 Dickinson Merino, 1 Southdown and 3 cross-bred lambs.

The distribution of crops for the season of 1897 is shown below:

Field.	Area acres.	Crop.
3	....	Experimental plots.
4	....	Small pasture lots.
5	....	5 acres Golden Dent corn and 1 acre beans.
6	27.64	8 acres oats, 2 acres barley, 5 acres roots, 2 acres wheat, 1 acre flax, 9 acres forage crops.
7	17.07	Meadow.
8	23.66	Hathaway Yellow Dent corn.
9	23.78	Meadow.
10	23.55	Varieties of wheat.
11	23.95	Meadow.
12	34.5	Pasture and hay, yield of latter 36 tons in barn, June 30, 1897.
13	30.	3 acres potatoes, 27 acres meadow.
14	20.9	6 acres experimental plots, 3 acres orchard grass, 3 acres millet, 8.9 acres corn.
15	13.15	Meadow.
16	44.19	Oats.
17	....	Woods.
18	....	Rough pasture.
19, 20, 21	....	Woods.

The report of the yields of these crops and the experiments connected with them will be made in connection with the report of the farm department of the Experiment Station in November next.

IMPROVEMENTS.

Drains have been extended in No. 16 to the wet places not reached by the drains laid in former years. New fences have been erected by students around field 15, the lane has been graveled farther south and the woodlots have been cared for according to the plans worked out and reported last year.

REPORT OF THE DEPARTMENT OF HORTICULTURE AND LANDSCAPE GARDENING.

To the President:

SIR—I submit herewith a report of the work of this department for the past year.

The instruction in horticulture has been along the same lines as in previous years, except that the time allowed for it has been increased one-half term, and the arrangement of the course has been slightly changed, The lectures to the juniors during the winter term cover the subject of plant propagating, floriculture, and vegetable gardening. The growing of the plants from seeds and cuttings, and by means of layering, grafting, and budding, was carefully treated, and the subject thoroughly illustrated. In the afternoon the students were given practice work in these same operations, either in the grafting-room or green-house. In floriculture the methods of progagating and handling various house plants, as well as the more common crops of commercial florists, were treated;

also considerable attention was given to the construction of glass structures of various kinds, including hot-beds, cold-frames, and small conservatories, as well as of the larger forcing-houses. The college greenhouses serve to illustrate this subject, and each member of the class was expected to prepare plans showing the arrangement of the house, as well as the details of construction. They were also required to make an estimate of the material required in the construction of the house, and the cost, and also to arrange a system of steam or hot water piping, for the heating of the house.

During the last half of the term the subject of vegetable gardening was taken up, and the matter of growing vegetables, both for the kitchen garden and for market gardening, was considered. Among the topics treated were those of the soil and location for gardens, manures and fertilizers, the draining and preparation of the soil, and the planting and the care of the leading crops of the garden. Some attention was also given to some of the more common insects of the garden, and the methods of treating them. In the spring term, the first six weeks were devoted to the subject of pomology or fruit culture. In this the treatment was much the same as for vegetables, and an attempt was made to place before the students the methods used by our best fruit growers in planting and caring for their orchards. At the same time the matter of growing fruits for home use was considered.

The remainder of the term was occupied with lectures relating to landscape gardening. The instruction was such as would enable one to lay out the grounds about a small home, or the farm house, and to plant them with the ordinary ornamental trees and shrubs. Considerable attention was given to the study of trees and shrubs best adapted to our climate. The members of the class were required to draw plans for the laying out and planting of the grounds of various sizes, as well as to prepare plans for a cemetery, school house and a small park.

Although it had not been placed in the course for the year, several of the seniors wished to give additional attention to the subject of horticulture, and to accommodate them a special class was arranged. The topics considered related for the most part to the matter of improvement of the varieties, and to the changes that take place in plants under various natural and artificial conditions. The juniors are also required to write an essay upon some subject relating to horticulture, which is also utilized as one of the essays required by the English department.

STUDENT LABOR.

Owing to the change in the course, the students now spend the first two years upon the farm, and for that reason the number assigned to this department has been comparatively small. Heretofore nearly all the labor upon the grounds, gardens, orchards and in the green-houses has been performed by the students; but as only one class is now thus assigned and all of its members are occupied for a greater portion of the year in educational labor, it has been necessary to make considerable change in the handling of student labor, and to rely largely upon regular hired men for the purpose of keeping up the work of this department.

During the year that the students work upon this department, an endeavor is made to make them as familiar as possible with the performance of the different operations of horticulture, and, beginning with the opening of the spring term, they are assigned to such work as is required by the various crops. The large number of trees in the orchards, and the shrubbery upon the grounds, afford abundant opportunity for thorough, practical instruction in the methods of pruning the different varieties, and the planting of trees, and the sowing of the various garden crops which follows, occupies the time for several weeks. Just before the close of the summer term, the flower beds are prepared and planted, and in the autumn the same beds are cleared and used for the planting of the spring flowering bulbs.

In the past the students have been here for most of the summer, and it has been possible to give them practice work in nearly all of the operations in horticulture; but in the future, owing to the summer vacation being lengthened, there will be something over three months during which the students will not be here, and it will be impossible to make the instruction as complete as heretofore. Owing to the fact that considerable help will be required at that time, there will be an opportunity for such of the students as wish to make themselves proficient in horticultural work, to remain and not only secure the knowledge, but obtain money that will aid in paying their expenses during the balance of the year. Aside from the practical work in horticulture, considerable time is given to the study of the various species of the plants grown in the gardens and orchards and upon the lawn, and in the examination of the different varieties of fruits and vegetables that are best adapted to our climate. Attention is also given to the judging of fruit and to the preparation and arrangement of fruit for exhibition.

THE SHORT COURSES.

During the winter two short courses in horticulture were arranged. One relating to fruit culture and the other to winter vegetable gardening and floriculture. The number of students in fruit culture was sixteen, which was fully as many as were expected. The subject was treated largely by lectures, and embraced even more thoroughly than in the regular course, the matter of planting and caring for orchards and small fruit plantations. Particular attention was given to the cultivation and care of orchards; to the spraying and the gathering and marketing of the fruits. In addition to the hour spent each day in the class-room, the students were required to devote at least one hour per day to reading along the lines treated in the lectures, and considerable time was also given to the discussion of the various matters relating to fruit culture. Practical work was also given in grafting, budding and the other methods of propagating plants, as well as to the pruning of the various orchard trees.

The number of students reporting for the course of floriculture was so small that no special class was arranged for them, especially as they wished to take the lectures in the course on fruit culture also. Arrangements were made by which they were able to attend the lectures given to the regular students in floriculture, and they were also given practical

instruction in the various operations of the green-house. We were fortunate during the continuance of the short course, to secure the assistance of a number of the leading fruit growers of the State, who spent each one day at the College, and delivered two lectures upon subjects relating to fruit culture. These were largely attended, not only by the special students in horticulture, but by the special students in stock and dairy husbandry as well as the regular students. The lectures of Roland Morrill, of Benton Harbor, upon "Commercial Peach Growing," and R. M. Kellogg, of Three Rivers, upon "Small Fruit Culture," were particularly valuable.

ORCHARDS AND GARDENS.

During the year 1896 the conditions were quite favorable for the production of fruit. The old apple orchard gave an extremely large crop, but the fruit was only of medium quality, owing largely to the fact that the trees were over-laden. About fifteen hundred bushels of the cider apples were sold, besides five hundred barrels of first quality apples, but owing to the large crop and small demand the price was quite low. They were readily sold during the winter and spring either at the College or in Lansing. The pear crop also was a good one, as was the cherry and grape crop. The small fruits were badly injured by the winter, and only a small crop was secured, while most of the European plums failed to set a crop. A large number of the American varieties gave large yields. In the spring of 1897 the prospects were excellent for crops of all kinds, except peaches, which were injured by the winter, although it was not expected owing to the large crop in 1896. The old apple orchard, in which nearly all of the trees are Northern Spy, blossomed profusely and set a fair crop of fruit. Good results were also obtained from the pears and plums, but the cherries did not give more than half a crop. The small fruits came through the winter in good condition, and the season was quite favorable for their growth, but at the time the fruit was ripening the weather was so hot that many of the berries dried upon the vines, although the ground was full of moisture.

The weather of the early spring was quite favorable for the growth of vegetables and good results were obtained with nearly all of them. Although the season was quite moist, we found the irrigating plant of considerable value in watering plants at time of transplanting and for furnishing water for the preparation of insecticides and fungicides. The aphides were quite troublesome during the spring, particularly upon the plum trees, and the warm, moist weather was very favorable for the growth of the fungi upon the fruits, but all yielded to the usual preparations.

THE GROUNDS.

The past season having been unusually favorable for the growth of lawn grass, the results have been unusually good, and throughout the summer of 1896 and the spring of 1897 they have, with few exceptions, been uninjured by the dry weather. It will, however, be advisable to insure against the effects of drought by providing an additional water supply sufficient to furnish water for the grounds about the dormitories, labora-

tories, and residences. The artesian well from which our present supply comes is now taxed to its utmost in warm weather, even though little watering of the lawns is done; but by providing another well the supply would be increased sufficiently to furnish all that would be required.

During the year few changes have been made upon the grounds, except that a number of flower beds have been laid out and a considerable amount of shrubbery planted. Last fall the side drive leading from the Station Terrace to Howard Terrace was discontinued and private drives to the residences provided. During the spring the drive in front of Abbot Hall was also closed, and a considerable amount of planting was done about that building. In the winter we used the teams for hauling gravel with which to cover the drives, and they were thus greatly improved. In the past year a large amount of work has been done upon the public drive along the north side of the College premises, and the improvement has not only been of value to the public who use this highway, but also prevents a large amount of wear to the College drives, from heavy teams passing through, as they have kept outside of the grounds since the highway was improved.

THE GREENHOUSES.

During the year the green-houses have been in charge of the florist, Mr. Thomas Gunson, who has occupied the same position for several years. Many of the palms and stove-plants purchased four or five years ago have made an excellent growth, and have become very fine specimens. During the winter a large number of bulbs were forced for winter flowering; and the number of roses, carnations and violets grown in the house was somewhat larger than in previous years. At least twice each week during the session of the Legislature, bouquets of flowers were provided for the desks of the President of the Senate and the Speaker of the House, as well as for a number of public functions at the Capitol. The grapery gave a large crop of fruit in 1896, and the crop now upon the vines is large and promising. This house, built from the better portions of the house torn down in 1892, has been very useful to the department in a number of ways.

INSTITUTES AND FAIRS.

I attended the long fruit Institute at Shelby, and on each day gave a talk upon subjects relating to fruit culture. The remainder of my Institute work was done during the summer, in attending short Institutes, at which I was the only one in attendance from the College. The first was held at Hudson and lasted one day, and brought out a large attendance. It was held in connection with a meeting of the Lenawee and Hillsdale Horticultural Society. The following day an Institute was held at Adrian in the same county, under the joint auspices of the Farmers' Institute and the Horticultural Society. Later on similar meetings were held at Traverse City, Chief and Frankfort, and at Rollin, Adrian and Petersburgh, in connection with the Farmers' Institute Society of the respective counties. Although the meetings were held at a busy time for the farmers, the attendance in most cases was good and much interest was manifested in the meetings. Considering the small expense of holding

the meetings, the results have been quite satisfactory, and whenever it will be possible to hold meetings of this kind in connection with the regular meetings of some organized society, the plan can undoubtedly be continued with success. Messrs. Gladden, Dean and Gunson, of this department, spent from three to four weeks each in Institute work. Mr. Gunson and myself attended the Round-up at St. Louis, and took part in the meeting.

This department made an exhibit of fruits and vegetables at the State Fair at Grand Rapids, and included in the exhibit a fine display of fruit from the Station at South Haven. The exhibit was in charge of Mr. Dean, who with myself aided in awarding the prizes for the fruit department of the fair.

HORTICULTURAL MEETINGS.

In December of last year I attended the annual meeting of the State Horticultural Society at Grand Rapids. The meeting brought out a large attendance and was particularly favored by the presence of a number of well known horticulturists from a distance, among them being J. H. Hale, of Connecticut, M. A. Thayer of Wisconsin, Professor Slingerland of Cornell University and Prof. John Craig of Ottawa, Canada.

In June I attended the summer meeting of the same society at Grand Haven and of the West Michigan Fruit Growers at Holland.

DISTRIBUTION OF FLOWER SEEDS TO THE PUBLIC SCHOOLS.

With the hope of exciting an interest in the decoration of school grounds in rural districts, on the part of patrons, as well as teachers and pupils, arrangements were made in the spring of 1896 to distribute collections of flower seeds to such districts as asked for them, and agreed to report results as well as to give them good care. The number of applicants numbered more than five hundred, and to each of the parties who applied within the time limit set, a collection of twenty-five varieties was mailed, with a circular giving directions for preparing the ground, and planting and caring for the seeds. Although each of the five hundred and twenty-five teachers, and a similar number of directors, signed a paper agreeing to have a report made at the close of the season, less than thirty reports were received, and few of them came until after November first, the date at which they were promised.

Of the reports submitted several spoke of partial or entire failures, due to causes beyond the control of the teacher or pupils, but most of them gave fairly favorable reports.

When the seeds were sent out, in order to increase the interest, five collections of hardy shrubs and evergreens were offered to the schools making the best reports. These were awarded as follows: District No. 8, Redford, Geo. Zeigler and Celia Rood, teachers; District No. 2, South Arm, C. H. Dewey, teacher; District No. 2, Sparta, Mrs. N. L. Vanzant, teacher; District No. 2, Boyne Valley, A. E. Farmer, teacher; District No. 3, Springport, John McClelland, teacher.

We append four of the reports, and would gladly print others did space permit. In District No. 2, Sparta, some half dozen reports were received

from the pupils and we give in full one of the letters acknowledging receipt of the shrubbery.

FLOWER-SEED REPORT OF DISTRICT NO. 8, REDFORD, WAYNE COUNTY, MICH.

[Preliminary Report by George Ziegler, Teacher in the Spring Term.]

We received our seeds about May 1st, and after studying the advice given as to methods of, and time for planting, we decided on May 16 as being most seasonable for all the seeds.

Owing to some miscalculation in regard to program, etc., we were unable to fulfill our intentions until the 23d of May. On that day the pupils, together with such of the parents and friends as cared to attend, were invited to participate in the exercises.

The children met at the school at the regular morning hour, for rehearsing pieces and for decorating the school-room.

This occupied most of the forenoon session, the spare time being spent in digging the flower-beds.

After dinner the children and friends met at the school at 2 o'clock.

The program was devoted to plants and flowers and was well rendered, both in music and declamation.

After the completion of the exercises, we repaired to the flower-beds, which had been fertilized by rich, black, loamy ground taken from a gully bottom near by, and proceeded to plant the seeds.

The following will show the arrangement of the beds:

At the left hand side of the walk was a star, the five corners of which were planted with wild violets, the center with amaranthus, a circle of candytuft and a second circle of zinnias.

To the right hand side was a crescent-shaped bed planted with pansy plants and other plants brought by the pupils. Farther to the right and slightly to the rear we planted some shrubbery.

Again to the right and back we made an oval bed, planted thus: Center, amaranthus; first circle, calendula; second circle, asters; third circle, balsam; fourth circle, portulaca.

Back of this a few feet is a heart planted thus: Center, gaillardia; first circle, calliopsis; second circle, petunia; third circle, mignonette.

About a rod from the rear we made a circular bed, in the center of which we planted verbenas; first circle, poppies; second circle, eschscholtzia; third circle, sweet william; fourth circle, phlox; fifth circle, French marigolds.

The left side of the yard is smaller and is used for wood. This prevented us from making beds on that side. We did, however, plant the nasturtium seeds along the front fence on that side and at both front windows we planted the morning glory and cypress-vine seeds.

Slightly back of the center of the right side we planted the sweet peas and sunflower seeds.

The sweet alyssum seeds were lost. Each pupil was given some of the seeds to plant in order that all might feel an interest in them. We completed the work by 5:30.

The report of growth, etc., will be made by my successor.

Truly yours,

GEORGE ZIEGLER.

FINAL REPORT BY CELIA ROOD, TEACHER IN THE FALL TERM.

Mr. Ziegler has given a full description of flower-beds, planting, etc. It remains for me to finish by giving report of the growth of the plants.

Our school opened September 14, and many of the plants were still blooming. Asters, marigolds, sunflowers, phlox, petunias, balsams, morning-glories and nasturtiums continued to bloom freely for some little time.

The sweet peas grew well, but were not kept picked as they faded, so did not bloom freely.

The mignonette and verbenas did not grow well, and only a few plants were seen.

The poppies, eschscholtzia, portulaca and candytuft were full of blossoms early in the summer, so the pupils tell me.

The amaranthus and calliopsis did very well; also zinnias.

Our cypress vines did not do well as they were near the morning glories and were over-run by them and choked out.

Our yard is well kept, and has been mown several times this season, and several of the pupils weeded and tended the flowers through vacation.

We have collected seeds from as many as we could to use next season.

The sweet william is in good condition for next spring.

I enclose an article from the Moderator, which gives an account of our success at our fair, where we took first premium on displays of balsams and marigolds.

Hoping we may be successful in securing one of the collections of shrubs, I am, yours,

CELIA ROOD,
Redford, Mich.

REPORT FROM DISTRICT NO. 2, SOUTH ARM TOWNSHIP.

EAST JORDAN, MICH., *August 1, 1896.*

Horticultural Department, Agricultural College, Michigan:

GENTLEMEN—Enclosed please find a plan of the flower garden of District No. 2, South Arm township, Charlevoix county. The following is a correct account of what was accomplished:

To begin with, we had a schoolhouse situated in the midst of some tall sand hills; or rather at the foot of a hill on the north side much higher than the 50-foot flag staff, and another hill on the east side much higher than the house, while south and west is a low swamp. The building and yard were unfenced, and the yard became the pasturage of all the neighbors' cattle.

The plan of having a garden was proposed and Arbor Day set as a time for a beginning. On that day all pupils brought tools—axes, spades, rakes, grub-hoes, fence post-hole digger and wheelbarrow, and proceeded to make a "general cleaning up," lay out a garden, set posts for its enclosure and plant some trees. We did it.

The posts were cut by the teacher and two boys and carried about one-quarter mile from the swamp on our backs. The borders between paths

and beds were made by laying small stones. They look very neat, sizes ranging with size of circles from 2 inches to 6 inches in diameter. One of the neighbors kindly loaned us his team, and four loads of muck from the swamp were placed on the garden. This was not half enough, however, the garden is so sandy. The wire around fence was donated by the teacher.

Five trees were set out on Arbor Day, but not having the wire for posts yet, a drove of cattle held a rampage among them on Saturday, destroying three of them. One nice aspen still lives. We expect to set out more this autumn. Seeds were planted at the time stated, and received the best of care. The abundant rains helped to bring them up nicely, but in spite of our efforts the flowers seemed destined to a worse fate than the shade trees. In June great numbers of grasshoppers flocked to our garden, attacking first our most delicate and tenderest plants. The nasturtiums and sweet williams were the last to go. The sunflowers, poppies and a few other plants still survive. Sods were cut and placed in the corners of the garden and watered. They are doing nicely. We expect to try again next year.

Very truly,

C. H. DEWEY,

Teacher.

REPORT FROM DISTRICT NO. 3, SPRINGPORT.

SPRINGPORT, MICH., *October 5, 1896.*

L. R. Taft:

DEAR SIR—In conformity with the condition that we report the degree of success of our undertaking in the matter of growing flowers on the school lawn, I must first thank the Agricultural College for their very thoughtful act of distributing seeds.

In preparing the ground and planting the seed, we followed the directions as nearly as our circumstances would allow.

One farmer very generously donated a quantity of manure, and the patrons of the school in general took a keen solicitude in our enterprise.

Although the pupils of the school are mostly young, the interest they took in the work equaled my every expectation, and not one of them would even think of discontinuing the work we have begun.

One very obnoxious difficulty we have met is that some unthinking people seem to have the idea that the flowers belonged to the public, and these acts of pilfering were very annoying, but the indignation of the patrons asserted itself, and I do not think we will be bothered by such acts in the future.

Notwithstanding the excessive amount of rainfall and other drawbacks, our flowers prospered and excited the delight and admiration of all lovers of the beautiful.

Our beds lead directly from the highway, but next year we will have them nicely fenced, and the ground being broken, I think we will have much better success in the future. Our seeds are nearly all gathered for the fall, the children taking home what is not needed at the school, and next year will have beds for themselves at home.

I think with a little extra trouble, most schools that received your very generous seed offer could save a collection of seeds to give any

neighboring school that might wish them, and thus many more school lawns could be rescued from their wilderness of weeds and be made much more attractive, as well as congenial, to the pupils.

Wishing to emphasize the fact that we have had a very decided success, I remain respectfully yours,

JOHN M'CLELLAN,
School District No. 3, Springport, Jackson County.

REPORTS FROM PUPILS OF DISTRICT NO. 2, SPARTA.

SPARTA, MICH., *September 17, 1896.*

L. R. Taft, Agricultural College, Lansing, Michigan:

DEAR SIR—We received the flower seeds in time to plant them. We did not plant them on the school grounds, as we intended to, on account of a new schoolhouse being built, besides we were afraid they could not be taken care of during the summer vacation, and so Mrs. Vanzant, our teacher, divided the seeds among the pupils. I had five kinds; all but one kind came up and were very pretty.

Last Friday each one of the pupils that had seeds brought flowers to school, and we had a very pleasant time.

We are going to gather the seeds this fall and divide again next spring.

Yours respectfully,
IVY FREEMAN,
Sixth Grade.

SPARTA, MICH., *September 18, 1896.*

L. R. Taft, Agricultural College, Lansing, Michigan:

DEAR SIR—The seeds which our teacher received from you were duly planted with accompanying directions.

We thought of different places for a garden, but finally decided to divide the packages of seeds among the children and let them plant them in their own flower gardens at home. This plan was thought best because it would be impossible to care for them on the school ground. I followed the directions for planting and they came up as their turns came. The mignonette was a very sweet-scented flower, and when brought into the house would fill the room with its perfume. The California poppy was noted for its beautiful leaves. The phlox is such a beautiful flower that it ought to be called the "Queen of the Garden." If there is only one flower in a garden, it ought to be phlox. The China asters grew well and had such pretty blossoms. Last week our teacher told us of your offer of reports, and I was one out of the sixth grade who was chosen to write a report. Wishing to be one of the favored schools, I remain,

Truly yours,
ERASTUS SMITH.

SPARTA, MICH., *May 4, 1897.*

L. R. Taft, Michigan Agricultural College, Lansing, Michigan:

DEAR SIR—We received the shrubs that were promised for the best reports from flower seeds sent out by you last spring.

We have them set out on the school ground, and they are doing nicely.

Yours truly,

ELLSWORTH BUCHANAN,

A Pupil from Grade 6.

ASSISTANTS.

During the year Mr. Thomas Durkin has continued as foreman of the work in the orchards and gardens, having charge of the men and teams, and with Messrs. Gladden and Dean, assistants in the Experiment Station, has had charge of a large amount of the practical work of the students in fruit culture and vegetable gardening, while Mr. Gunson has given the instruction in practical floriculture.

L. R. TAFT.

Agricultural College, June 30, 1897.

REPORT OF THE MECHANICAL DEPARTMENT.

To the President:

SIR—I have the honor of submitting the following report of work done in the Mechanical Department during the year ending June 30, 1897.

The work in the class-rooms, drawing-rooms, etc., has been conducted according to the following scheme:

FALL TERM.

Seniors—Thermodynamics and Valve Gears by Prof. Weil. Experimental Laboratory by Prof. Weil and Mr. Smith. Steam Engine Design and Graphical Statics of Mechanism by Mr. Westcott.

Juniors—Elementary Kinematics by Mr. Westcott. Machine Design by Mr. Smith. Metallurgy by Prof. Weil.

Sophomores—Shop Methods by Mr. Leonard.

All Classes—Shop Practice by Messrs. Leonard, Hoyt and Theadore.

WINTER TERM.

Seniors—Advanced Kinematics by Prof. Weil. Steam Engineering Laboratory by Prof. Weil and Mr. Smith. Advanced Machine Design by Mr. Leonard.

Juniors—Machine Design and Boilers by Mr. Westcott.
Sophomores—Elements of Machine Design by Mr. Smith.
All Classes—Shop Practice as in the Fall term.

SPRING TERM.

Seniors—Engineering Practice and Thesis Work by Prof. Weil. Original Machine Design by Mr. Leonard.

Juniors—Strength of Materials and Testing Materials of Engineering by Mr. Westcott.

Sophomores—Elements of Steam Engine by Prof. Weil. Elements of Machine Design by Mr. Smith.

All Classes—Shop Practice by Messrs. Leonard, Hoyt, Theadore and Smith.

No change was made during the year in the regular studies and exercises of the department, but it became necessary, however, because of the resignation of Prof. Chamberlain, to make a change in the apportionment of work among the instructors.

On account of the change recently made in the time of holding the long vacation it was not found possible to build as much apparatus, or do as much in the way of repairs, during the past year as in the case of previous years. We have, however, during the past year, practically completed a ten-inch wood lathe, with iron bed, and also made a number of small tools. We have also thoroughly overhauled, and put in order, the shop shafting, and repaired the pumps at the boiler house. At the present time our shop instructors and a force of students are engaged in making repairs and improvements in the various shops, and the work will be continued during the greater part of the summer vacation.

The following are the more important additions by purchase since June 30, 1896:

Smith Premier typewriter.
Reversible blackboard.
Micrometer caliper.
Starrett inclinometer.
Olmsted miter box.
Langdon miter box.
Coffin averaging instrument.
Houghtaling reducing rig.
Slide rule.
2½ H. P. Olds gasoline engine.
5 H. P. Olds vertical steam engine.
6-inch Ericsson hot-air pumping engine.
No. 3 Chief injector.
Kinealy draught gauge.
Anemometer.
16-inch Hendy-Norton engine lathe.
13-inch four-jaw independent chuck.
100-lb. foundry ladle.
Three foundry crucibles.

A few small tools have been added to our equipment in the blacksmith shop and foundry; in the wood shop a considerable addition has been made in the way of planes, chisels, etc.

We have been particularly fortunate in being able to secure considerable apparatus necessary for enlarging on the experimental work of this department. Also through the kindness of Thoman Bros., we have been able to arrange what constitutes practically an auxiliary laboratory for tubular boiler and Corliss engine work at Thoman's mill, Lansing. At the present time we are engaged in making quite extensive alterations and improvements in the experimental engineering room.

At the end of the summer term of 1896, Prof. Chamberlain resigned to accept a position as professor in the Lewis Institute at Chicago, and Mr. V. V. Newell resigned at the same time in order to enter the employ of Henry R. Worthington of Brooklyn, N. Y. Messrs. Chamberlain and Newell had rendered this department much good service and they carried with them, on their departure, the best wishes of their associates.

Mr. W. S. Leonard and Mr. H. E. Smith were engaged as instructors in this department at the beginning of the past college year, and they have shown themselves to be able and efficient in their respective lines of work.

During the past year a session of the annual convention of the Michigan Engineering Society was held at the College, and at the close of the convention the society adopted the following resolution:

Resolved, That the Michigan Engineering Society hereby expresses its high appreciation of the technical training furnished by the great educational institutions of this State, the University of Michigan, the Agricultural College, and the Mining School, and earnestly recommends to all young men, who have any branch of engineering in view as an occupation, to avail themselves of the advantages offered by these institutions.

In conclusion I will say that it is gratifying to note that the members of the graduating class of 1896 are now generally employed in engineering work, and are holding fairly lucrative positions.

Respectfully submitted,

CHAS. L. WEIL,

Professor of Mechanical Engineering.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1897.

REPORT OF THE STEAM AND WATER DEPARTMENT.

To the President:

SIR—I have the honor of submitting the following report of the work of the Steam and Water Department for the year ending June 30, 1897:

Steam has been supplied for heating, pumping, dynamo and shop engines, as usual.

Mr. E. A. Edgerton resigned his position as engineer on the first of May, 1896, and Mr. D. B. Baldwin was engaged to fill the vacancy on July 6, 1896.

The tank and feed pumps have been put in good order; new plungers and rings were purchased for the tank pump.

The only other work of particular importance in the way of repairs and alterations done in this department, during the year, was in connection with the boiler settings and the main steam piping. All brick work was thoroughly overhauled and put in good order, and the piping arranged for running separate batteries of boilers at high and low pressure. The arrangement of the piping affords very satisfactory results.

Attention is again called to the desirability of building a new coal shed, also of placing hose and nozzles in the several dormitories. It is recommended that suitable scales be placed at the boiler house for weighing coal and ashes.

Respectfully submitted,

CHAS. L. WEIL,
Superintendent.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1897.

REPORT OF THE CHEMICAL DEPARTMENT.

President Snyder:

The annual report of the Chemical Department for the year ending June 30, 1897, is herewith submitted. The year has been one of business activity and prosperity in the Chemical Department. We have never before had so many students or more satisfactory work.

When the Chemical Laboratory was erected it was supposed that ample room had been provided for as many students as would ever gather in any term within its walls. But with the large influx of students and multiplication of classes, it is becoming a question how to provide working space and elbow room for all the students in the laboratory, for successful instruction in chemistry cannot be separated from laboratory work. Now that the Woman's Course comes in to claim a large place in the Chemical Course, the stress becomes greater.

The nature and amount of work may be seen from the following abstract of the year's work in this department:

CLASS ROOM. LABORATORY WORK.

FALL TERM.

Organic Chemistry, Agriculturals.
Volumetric Ananlysis, Agriculturals.
Quantitative Analysis, Agriculturals.
Meteorology, Agriculturals.
Metallurgy, Mechanicals.

WINTER TERM.

Agricultural Chemistry, Agriculturals.
Elementary Chemistry, Agriculturals.
Elementary Chemistry, Mechanicals.
Laboratory Work, Mechanicals.
Laboratory Work, Agriculturals.
Agricultural Chemistry, Special Students.

SPRING TERM.

Analytical Chemistry, Agriculturals.
Laboratory Work, Agriculturals.
Laboratory Work, Mechanicals.
Elementary Chemistry, Agriculturals.
Kitchen Chemistry, Woman's Course.

EXPERIMENT STATION WORK.

The chemical work in the Experiment Station has been equally pressing, the time of the Assistant in Chemistry being fully occupied. A part of this work may be outlined as follows:

1. Fertilizer Analysis. The collecting in the open market of samples of all kinds of fertilizers offered for sale in the State, analysis of the same and tabulating the results for publication in the Bulletin for information of farmers and gardeners, demand a large amount of work and skill when we consider that some sixty specimens were collected. The fact that the fee for license to sell each fertilizer is $20 is an agreeable consideration.
2. Analysis of milk, butter and dairy products from the Farm Department in solution of many practical questions, requires much and careful work. More than 100 specimens have been analyzed during the year.
3. The analysis of grasses, fodders, silage, feeding stuffs of many kinds required by the Farm Department, has brought a large amount of work. Some fifty specimens have been analyzed in this way.
4. Analyses in smaller number have been made for the Horticultural, Bacteriological and Entomological Departments.
5. Analysis of drainage water to determine the loss of manural matter from the soil.

6. Analysis of the water supply at the College in connection with questions of the health.

OUTSIDE WORK.

By request, I attended the meeting of the American Society of Florists in Cleveland in August, 1896, to read a paper on the Chemical Tripod in Floriculture. The article was published in the American Florist and called out a long discussion as to the source of the ash elements in air plants, leading to the conclusion that air plants (Orchids) no less than soil plants require mineral matter for their successful and continued growth.

In February, 1897, by request, I appeared before the Michigan legislature and gave an address on the Cultivation of Sugar Beets in Michigan.

FARMERS' INSTITUTES.

In December, 1896, I attended a long Institute at Shelby, giving a lecture on Agricultural Chemistry for four days in succession.

On January 11, 1897, I attended the twenty-first anniversary of the first Farmers' Institute held in this State, giving a history of Farmers' Institutes in this State, their growth here and spread into other states and even foreign lands. Many of what may be called the charter members of the Farmers' Institutes were present at this anniversary meeting and recalled the incidents of the first meeting. Gen. Pritchard was again the presiding officer, and gave life and dignity to the occasion.

On March 3, 1897, I attended the Round-up Institute at St. Louis and gave an address on Sugar Beets.

The Adjunct Professor of Chemistry devoted three weeks to work in Institutes, attending Institutes in Kalkaska, Harbor Springs, Traverse City, Copemish, Benzonia, Lake City, Hastings, Scottville, Chase and Hersey.

Respectfully submitted,

R. C. KEDZIE,
Prof. Chemistry.

F. S. KEDZIE,
Adjunct Prof.

REPORT OF THE DEPARTMENT OF BOTANY AND FORESTRY.

To the President:

SIR—I herewith submit my report for the year closing June 30, 1897.

During the year students have received instruction in this department as follows:

Freshmen in structural botany, sixteen weeks daily	58
Sophomores in systematic botany, fourteen weeks daily	30
Sophomores in trees and shrubs, eleven weeks, three lessons per week	37
Sophomores in systematic botany, an extra class, 4 weeks	6
Sophomores in physiological botany, twelve weeks daily	36
Juniors in weeds, grasses and farm crops, eleven weeks daily	36
Seniors in parasitic fungi, fourteen weeks daily	7
Seniors in preparing theses, three to sixteen weeks daily	7
Students in special course in horticulture, six weeks	13
Students in special course in dairying, six weeks	16
Students in special course in live stock, six weeks	13
	259

THE HERBARIUM.

An unusually small number of plants have been added to the herbarium the past year, owing to the reduction of money allowed the department for making purchases.

MUSHROOMS AND TOADSTOOLS.

The special feature of the year in this line has been the collection of Saprophytic fungi, popularly known as mushrooms, toadstools, and the like. This is of especial interest in an economic way, since many tons of good food, as valuable as beefsteak, go to waste in this State, simply from a lack of knowledge to enable the farmer and others to distinguish the edible from the poisonous. By means of this collection, already considerable interest is manifested in several portions of the State. Thrifty societies of enthusiasts have been formed at Grand Rapids and Flint. At the former place Professor Wheeler gave a lecture on such fungi, and from Flint came a special messenger at two different times, Dr. J. N. Buckham, to see and learn all he could of our collection and methods of work. A considerable number of enterprising people of Lansing have learned to collect and eat this excellent food.

Instructor Longyear has paid a good deal of attention to this branch of the work during the past year and a half, and Professor Wheeler also has been able to devote some time to collecting and identifying.

At Ann Arbor, before a meeting of the State Academy of Science, Mr. Longyear presented a paper from which I quote liberally. "It was soon found necessary to observe the color of the spores of the Agaricineæ, and

this is done while the specimens are yet fresh. We have succeeded in securing good spore-prints in the usual manner by carefully removing the pileus and placing it gills down on a piece of gummed paper and covering the whole with a bell jar. The process usually requires from twelve to twenty-four hours. White paper is used for all specimens having colored spores, and black paper for those having white or colorless spores. The moisture of the fungus is usually sufficient to soften the gum on the paper so that the spores are held when dry. The spore prints are also accompanied with drawings of a vertical section of the fungus, thereby showing the width of the gills and their relation to the stipe, besides other features of the specimen which often determines its generic position. Notes are also taken of odor, taste, colors, etc., of the specimen when fresh.

"Our collections are arranged in interchangeable pasteboard trays, one inch deep and varying in size from four and one-half by six to nine by twelve inches. These are temporarily placed in wooden trays which will just contain four of the largest pasteboard trays. We have been able to collect during every month of the year and have secured many specimens of such genera as Polyporus, Polystictus, Fomes, Stereum, Corticium, Peniophora, and allied genera, since the first snow came. Some species of gill fungi also persist throughout the winter ready to take advantage of every warm day. Among the most persistent are those belonging to the following genera: Lenzites, Schizophylum, Pleurotus, Collybia, and Mycena in the white spored, and Crepidotus in the yellow spored sections. The most tenacious species are those that grow on wood. Not a few species belonging to the Hydneæ and Tremellineæ are also available to the winter collector. Among some of the notable specimens which were secured last season may be mentioned a plant of Lycoperdon giganteum weighing, when fresh, seven pounds ten ounces and measuring forty-five inches in circumference, while compared with this are some specimens of Geaster minimus, a star puff ball, weighing only a few grains. The moist, warm weather of 1896 also brought out some very large specimens of gill fungi. Among the attractive species we have a large tray of the bright red Polyporus cinnabarinus, brought from Lewiston, Montmorency county, by Dr. Beal when on Institute work. This grows on canoe or paper birch.

"We have between two hundred and fifty and three hundred species of Basidiomycetes, representing ten of the thirteen families of this group and covering nearly seventy genera. The indentification of this material is the most serious problem that we have encountered. This is partly due to the meager literature on the subject in the United States. The North American Fungi of Ellis and Everhart have aided us much, and we are also especially indebted to Prof. Chas. H. Peck of the New York state museum for the identification of some of this material. The reports of this botanist have been of much assistance to us.

"That this subject presents an economic as well as a scientific side is becoming more clearly recognized. While mushroom eating has been practiced for many years, yet the persons indulging in this semi-hazardous practice almost invariably confine themselves to the ascomycetous morel or the common mushroom, Agaracus campestris. All others are called 'toadstools' and considered poisonous. But the progressive fungus eater

will not be satisfied to confine himself to these two forms, but will enlarge his list to at least a score of species suitable to cater to his wants. The gnawed remnants of Polypori found on stumps and logs during the winter seem to attest to the high estimation in which some of these fungi are held by the squirrels. Many pounds of fairy-ring mushrooms, Marasmius oreades, grew on the College campus last season and were eagerly sought for by people from the city of Lansing. No doubt many persons are restrained from the use of these plants as food through fear of the poisonous qualities of certain species; and, while this fear has been a safeguard against accident, it has also been the means of depriving these persons from a food of palatable and highly nutritious qualities. While care is necessary in the collection of mushrooms for food, still one can learn with careful observation to readily discriminate between species so that the deadly Amanita and its noxious relatives may be avoided.

"The handsomely illustrated book, 'Our Edible Toadstools and Mushrooms,' by the late Hamilton Gibson, is doing much toward popularizing the eating of mushrooms among those who have access to the book. The forty-eighth report by Prof. Peck, recently received, should be mentioned in this connection, as it contains many illustrations and descriptions of edible fungi found in the state of New York. A smaller work of similar character by Julius A. Palmer, Jr., is also a desirable book for those wishing to become familiar with the commonest forms of edible fungi. The scientific side of the subject is a field which seems to have been but little worked in our State, although our woods and fields and even our dooryards can furnish abundant material. A surprising number of species can be found in a limited area. Very much the larger part of our collection has been made in a piece of woods about seven acres in extent lying a little north of the College campus. It is our intention to continue making a careful study of these plants in our county and State, and we should be pleased to communicate with persons interested in this subject. We will endeavor to identify specimens sent us."

There have been added the past year flowering plants, ferns and their allies from:

A. A. Heller, Idaho plants	330
S. B. Parish, plants of southern California	106
A. H. Curtiss, series 4, of Florida	200
C. G. Pringle, Mexican plants	300
C. K. Dodge, Port Huron and vicinity	158
J. M. Holzinger, Carices from Pike's Peak	16
L. H. Bailey, Carices, desiderata	20
H. C. Skeels, plants from Delavan, Wis	33
Miss E. J. Cole, Colorado plants	6
C. F. Baker, Colorado plants	43
C. A. Davis, plants from Huron county	62
H. H. Rusby, plants from South America	30
Collections of plants at the College, mostly desiderata	100
A. A. Crozier, collections in Mexico and New Mexico	150
C. D. McLouth, plants from Muskegon	40
	1,594

MOSSES.

J. K. Small, from southwest United States	51
A. A. Heller, from Idaho	60
	111

Fungi.

Sydow, Europe	100
J. B. Ellis, century 35	100
Arthur and Holway	31
Collections in vicinity of the College, parasitic species	50
Collections in vicinity of the College, saprophytic species, with many duplicates	300
	581

Lichen.

Cummings, Williams and Seymour	42

Algæ.

Collins, Holden and Setchel, 5th and 6th, Fasc	100
Josephine E. Tilden	100
A. H. Curtis, Florida	50
	250
Total additions the past year	2,578

GENERAL SUMMARY OF PLANTS IN THE HERBARIUM.

Flowering plants (Spormatophyta)	49,158
Ferns and their allies (Pteridophyta)	1,106
Mosses and Liverworts (Bryophyta)	1,867
Lichens	1,061
Fungi	8,721
Algæ	645
Total number in the herbarium	62,558

LARGE DRAWINGS.

During the spring term we were able to arrange the work of the department so as to allow Mr. Longyear to devote most of his time to preparing large water-colored drawing on muslin. Most of these cover points of especial economic importance, such as representations of the life history in detail of corn smut, wheat rust, wheat smuts, the various fungi that

blast the hopes of the grower of apples, peaches, plums, cherries, melons, beans, tomatoes, potatoes, and other cultivated plants.

These drawings are not simply copies of other drawings, but in all cases are made from original sections, cultures and full-grown specimens. They are as good as anything I have ever seen in use by any botanist, and to us they are especially valuable for instruction in special courses at the College and at Farmers' Institutes.

THE BOTANIC GARDEN.

This area along both sides of the brook consists of two acres; another acre near the boiler house is devoted to grasses, other forage plants, and weeds. In all there are a little over 1,800 species of plants found growing there.

I present here the substance of two papers which were read at meetings in Detroit, last August:

*In managing a small botanic garden for the past twenty years, my attention has often been forcibly called to many peculiarities of plant growth. An attempt has been made to grow well in suitable spots in the open air over 2,000 species of hardy plants. These plants were collected in Michigan and elsewhere, from woods, river bottoms, marshes, swamps, open fields where the soil was wet, dry, loam, muck, sand or clay. Considerable knowledge has been gained in person by digging plants in their native haunts and by transferring them at different seasons of the year from one portion of the garden to another.

Many years ago I started out with the thought somewhat vaguely fixed in mind that I might find a spot congenial to each species and there plant a patch of it and it would thrive for all time to come, or at least for my time. Most of the plants started well and thrived remarkably in their new homes which I had selected, but after two to six years or longer, many of them began to show signs of failing or died outright, notwithstanding all other species of higher plants in each case were diligently kept from intruding, and usually some fertilizers were employed. Neither were the plants in the patches allowed to crowd very closely, for they were thinned as occasion seemed to require.

I learned long since that there is no such thing as planting once for all time. There is no such thing as stability, for plants need a change sooner or later and will have it or perish.

After a few years plants of the mint family of thirty to sixty species began in numerous cases to show lack of thrift. The ground was clogged with thick mats of rootstocks starving for more room. They were thinned, but still they dwindled. A number were affected with rust and other fungi, and numerous insects had learned where to find them—in fact, seemed to have settled down to live in that bed of plants. The following plants, especially, failed or died in the middle of each plot, and the healthier portions were to be seen about the margins where rootstocks had encroached on new soil:

Glecoma hederacea, Lycopus sinuatus, Lycopus Virginicus, Mentha Canadensis, Monarda didyma, Nepeta Cataria, Vleckia nepetoides.

*[Read at the meeting of A. A. A. S., held in Detroit, August, 1897.]

The plot of wild asters and goldenrods in like manner has recently suffered much from certain insects working at the roots, as well as at the tops, and several parasitic fungi have injured some of them. Insecticides have been employed, still, from one cause or another, after a few years, several species have been lost. In some instances it appeared to be due to unfavorable weather.

A number of species of sunflowers *(Helianthus)* were nearly destroyed by rust and mildew, and some patches became nearly extinct, where the roots had slowly fed over the ground. A thrifty piece of iron-weed *(Vernonia)* five or six feet in diameter nearly all died last year, as a hint that a new place was needed. A little on the spreading margin was left alive.

After growing four years in nearly the same place, a thrifty piece of *Euphorbia dentata*, an annual brought from central Indiana, all succumbed to a rust, and *Euphorbia nutans* is likely to do likewise. I will say that I have lately found a couple of healthy plants of *Euphorbia dentata* near where the patch was located several years ago, and healthy plants of *Euphorbia nutans* can be found in isolated places.

I have within twenty years seen numerous patches of shepherd's purse become nearly extinct on account of attacks of *Cystopus candidus*, and patches of knot grass nearly exterminated by rust. In some of these localities a new crop, after a few years, sprang up where the ground had been plowed.

Where things have gone on in a rather monotonous way for some years, certain insects settle down, live and thrive; meadow mice, moles, squirrels, rabbits, muskrats—all learn the way, and the longer a plant remains in one place in considerable quantity the more it is likely to be disturbed by some of these enemies. As previously observed, the same may be said of all sorts of rusts, mildews, microbes and the like.

In mellow soil, such as the following plants delight in, the rootstocks (in a few, the roots) run rampant in every direction, encroaching on other plants and producing a mixture of species sometimes difficult to untangle. Most of them are the pest of gardeners. Here are thirty-seven of them:

Agropyron repens, Apios (tuberosa) Apios, Apocynum cannabinum, Aristolochia Clematitis, Asclepias Sullivantii, Asclepias Syriaca, Bocconia cordata, Capriola (Cynodon) Dactylon, Carduus (Cnicus) arvensis, Carex riparia, Carex trichocarpa, Convolvulus Sepium, Coronilla varia, Cyperus rotundas, Linaria (vulgaris) Linaria, Lycium vulgare, Lycopus sinuatus, Lycopus Virginicus, Lysimachia Nummularia, Lysimachia quadrifolia, Lysimachia (stricta) terrestris, Mentha piperita, Mentha (viridis) spicata, Onoclea sensibilis, Onoclea Struthiopteris, Poa pratensis, Populus alba, Reseda lutea, Robinia hispida, Robinia Pseudacacia, Robinia viscosa, Sagittaria latifolia, Stachys palustris, Teucrium Canadense, Thermopsis Caroliniana, Tussilago Farfara, Tussilago Petasites.

In our botanic garden, to keep some of these plants within reasonable bounds, they were placed each within a piece of old smoke-stack a foot and a half in diameter and about two feet deep. Some of the plants do very well this way, but several of them leave the center vacant and run around the edge of the enclosure, reminding one of uneasy animals in a cage, while the Canada thistle thrives, putting its roots down deep into the soil. The first you know, these roots of the thistle run under the iron hoop and new plants pop up serenely from two to five feet distant.

Plants that run around the margin are *Stachys, Teucrium, Aristolochia Clematitis*, while feeble plants of *Linaria Linaria*, though in rich earth, failed utterly last season. We had to change the soil and put in new plants to keep the stock good. They are impatient of restraint and want to ramble about at will, as plants almost seem to have a will.

The following twelve perennials among others in the garden have failed more or less or died, especially in the middle of the patch:

Boltonia asteroides, Coreopsis lanceolata, Glecoma hederacea, Helianthus giganteus, Helianthus grosse-serratus, Marubium vulgare, Rudbeckia speciosa, Scrophularia Marylandica, Spathyema fœtida, Uvularia perfoliata, Viola lanceolata, Vleckia (Lophanthus) nepetoides.

Here permit me to quote a little from a paper presented at the recent meeting of the Society for the Promotion of Agricultural Science:

"It is very instructive to note how much better many of the weeds thrive when they get away from the spots where they have been confined for two to six years. Seedlings of *Datura Tatula* are larger in the bed of *Plantago major* than they are in their own bed where their parents grew. After three years the plantain mentioned has nearly run out, and *Amaranthus albus* has entirely disappeared. *Chenopodium album* grew finely for a couple of years, but of late has made a small display, and has suffered from the attacks of insects and probably from other causes.

Panicum Crus-galli behaved like *Chenopodium*, and has had a hard time of it, needing considerable attention. Barnyard grass likes the best that can be got, and if it can't get that, will go into a rapid decline.

The seedlings of *Polygonum Persicaria* are feeble this year and are overtopped by intruders from adjoining plots, such as ragweed and prickly lettuce.

Chenopodium glaucum doesn't seem very persistent for a plant that ranks among the weeds, but it shies off from its home ground as though searching for fresh fields. *Thlaspi arvense* is very feeble, and, like the last, seems to be hunting for a soft place that just suits it. *Polygonum aviculare* grows near the foot-path about the doors of dwellings, and thrives with abuse, seeming to enjoy tramping upon by feet, but in my plots, I have difficulty in growing it. Insects prey upon it; rust causes it to dwindle and disappear. Motherwort grows rank, four feet high near the barnyard fence, and the flowers are covered with bees, but when kept several years in the same bed it goes off into the sulks as though neglected. In moist, rich and mellow soil *Cyperus esculentus* grows luxuriantly for a couple of years, and after that makes little display, as though tired out and pining for something new."

Almost every one has seen or heard about fairy rings often seen in lawns or old pastures. Here some species of fungi, such as *Marasmius oreoides* and others, spread out a foot or so each year, more or less, in the form of a circle, killing or weakening the grass where it grows. These plants seem to require a fresh place for growth each year.

Marsilia quadrifolia and the wild rice *(Zizania aquatica)* have often been driven from the pond to the extreme margin and sometimes above the edge of the water by some insect, crustacean or snail. Beyond the reach of these enemies they thrive well from year to year. During the winter of 1894-95 the ice on the pond was solid and of unusual thickness for many weeks. The loss of air, with the cold or something else, caused the death of all the fish and most likely many of the other small animals. The following summer Marsilia and wild rice spread out and grew in the water as never before nor since, for their enemies had been killed. Pringle, in notes on Mexico, speaks of collecting grasses beneath the thorn bushes, where they had not been reached by cattle.

Wallace, in his work on Darwinism, says:

"People do not see the constant and daily search after food, the failure to obtain which means weakness or death; the constant effort to escape enemies; the ever-recurring struggle against the forces of nature."

This statement, made with reference to animals, seems to apply equally well to plants. Again I quote from Wallace:

"It is not so commonly known that if a garden is left to become altogether wild, the weeds that first take possession of it, often covering the whole surface of the ground with two or three different kinds, will themselves be supplanted by others, so that in a few years many of the original flowers and of the earliest weeds may alike have disappeared. This is one of the very simplest cases of the struggle for existence, resulting in the successive displacement of one set of species by another; but the exact causes of this displacement are by no means of such a simple nature. All the plants concerned may be perfectly hardy, all may grow freely from seed, yet when left alone for a number of years, each set is in turn driven out by a succeeding set."

DeCandalle says:

"All the plants of a country are at war with each other, each one struggling to occupy ground at the expense of its neighbor."

Again from Wallace:

"Besides this direct competition, there is one not less powerful arising from the exposure of almost all plants to destruction by animals. The buds are destroyed by birds, the leaves by caterpillars, the seeds by weevils; some insects bore into the trunk, others burrow into the twigs and leaves; slugs devour the young seedlings and the tender shoots, wireworms gnaw the roots. Herbivorous mammals devour many species bodily, while some uproot and devour the buried tubers.

"Besides having to protect themselves against competing plants and against destructive animals, each species can sustain a certain amount of heat and cold, each requires a certain amount of moisture at the right season, each wants a proper amount of light or of direct sunshine, each needs certain elements in the soil. The struggle for existence in plants is threefold in character and infinite in complexity.

"We must not overlook the fact so well established that one of the greatest points to be gained by migration, is to enable the flowers of different stocks of a species to be cross-fertilized and thereby improved in vigor and productiveness.

"No doubt many of these facts are familiar to you, if so, all the better, for we can then discuss their meaning to greater advantage. They teach emphatically some of the good reasons for a rotation of crops, which means new fields for old or for new plants. As Lubbock says in his "Flowers, Fruits and Leaves": 'Farmers have found by experience that it is not desirable to grow the same crops in the same field year after year, because the soil becomes more or less exhausted. The powers of dispersion possessed by many seeds are a great advantage to the species. Moreover they are also advantageous in giving the seed a chance of germinating in new localities suitable to the requirements of the species.' "

People often think of animals as traveling from place to place, but forget that plants can travel as well. By an almost infinite number of devices seeds and fruits of plants flee from the parental spot on the wings of the wind, float on currents of ocean, lake and river. They are shot by bursting pods and capsules in every direction. With hooks and glands they cling to the coverings of animals. Allured by brilliant colors, birds and many other animals seek and devour the fruits of many plants, the

seeds of which are preserved from harm by a solid armor and are soon sown broadcast over the land ready to start new colonies. Nuts are often carried by squirrels, a few in a place, for many rods and there securely buried. By a slow process which amounts to considerable in a few years, many plants send forth roots, rootstocks, stolons and runners, and thus increase their possessions or find new homes.

The various devices by which plants are shifted from place to place is not merely to extend and multiply the species and reach a fertile soil, but to enable them to flee from the great number of their own kind, and their enemies among plants and parasitic plants. The adventurers among plants often meet with the best success, not because the seeds are larger or stronger or better, but because they find for a time more congenial surroundings. Our weeds are good illustrations of this point. They are carried for long distances by man and by him are planted in new ground that has been well prepared. Every horticulturalist knows that apples grown in a new country, if suitable for apples, are fair and healthy, but the scab and codling moth and bitter rot and bark louse sooner or later arrive, each to begin its peculiar mode of warfare. Peach trees in new places remote from others are often easily grown and free from dangers, but soon will arrive the yellows, borers, leaf curl, rot, and a number of other enemies to combat. For a few years plums are grown without danger from curculio or rot or shothole fungus. It has long been known that the surest way to grow a few cabbages, radishes, squashes, cucumbers or potatoes is to plant them here and there in good soil at considerable distances from where any have heretofore been grown. For a time enemies do not find them. I have often noticed that while pear blight decimated or swept off large portions of a pear orchard, a few isolated trees scattered about the neighborhood—many neighborhoods—usually remain healthy. The virgin soil of the Dakotas produced at a trifling expense healthy, clean wheat, but it was not long before the Russian thistle, false flax and other pests followed to contest their rights to the soil. If, as in endemic species, they seem for some reason to be much restricted, they are very likely to become extinct and give way to those not so restricted. Perhaps one reason why some plants have become extinct or nearly so is their lack of means of migration. As animals starve out in certain seasons when food is scarce, or, more likely, migrate to regions which can afford food, so plants desert worn-out land and seek fresh fields. As animals retreat to secluded and isolated spots to escape their enemies, so many plants accomplish the same thing by finding the best places with some of their seeds sown in many regions. Frequent rotations seem to be the rule for many plants when left to themselves in a state of nature. Confining to a permanent spot invites parasites and other enemies and a depleted soil, while health and vigor are secured by frequent migrations.

THE WEED GARDEN.

For about five years past, the Botanical Department at Michigan Agricultural College has maintained a weed garden in which one hundred species or more of our most troublesome weeds are grown in plots, each five by six feet, and all plainly labeled with common and scientific names. For ten years previous a smaller garden was maintained for a portion of

the time. These plots are instructive to students and visitors, and to no one more than to the one who designed and manages the garden. Here many agricultural students resort and make collections of seeds for immediate or future study, and sometimes herbarium specimens as well.

Such a garden is especially appropriate at an agricultural college or experiment station. A professor of our State Normal School was so much impressed with such a garden as an educator, after seeing ours, that he forthwith secured a suitable spot and started one on a portion of the campus.

In some respects my experience in connection with these weeds has been different from that of most others, much depending on the particular locality, the exposure and the nature of the soil. The land I have used slopes to the south and more than half of it is moderately stiff clay. The perennials and biennials have remained in most cases each in the same plot; the annuals have usually been self-seeding. The soil, not having been spaded over, has become pretty solid. As every experimenter with plots has observed, where the plants are at all crowded, those around the margins of the plot are larger than those near the middle. As we might expect, seeds of many of these weeds find their way into surrounding plots, there to contest the space with others or to make trouble to the person who tends the garden. It is very instructive to note how much better many of these plants thrive when they get away from the spot where they have been confined for two or four years or more.

Some grains of *Bromus secalinus* were sown in the spring of '96 and made a stout growth with not a sign of a panicle. Part of it winter killed. In autumn of '96 more grain was sown adjoining the first that was sown in spring. On June 20 of this year the panicles of both lots of plants are of the same height and vigor, and there cannot be two days' difference in the time of blossoming. As we have this plant, its habit is pretty well fixed, so it requires an autumn, a winter and a spring, with a little of early summer, to run its course. *Iva xanthifolia* we have grown for several years, though it is not known in the southern peninsula of the State. The plants thrive in the upper peninsula, where they probably came from the west and lodged as in the mouth of a great cornucopia open to the west. This plant has not emigrated into the southern peninsula, probably because it doesn't understand navigating the waters of Lake Michigan. In gathering seeds from melting snow, the last of a snow bank, a single seed of *Cycloloma platyphyllum* was found. Diligent search was made the next summer without finding any plants of this species, and none had formerly been found.

Shephard's purse is often much affected with a fungus knows as *Cystopus*, so much so that large patches scarcely produce any seeds and large areas perish from the face of the earth. Cocklebur often has a hard struggle here on account of the attacks of a mildew, and more recently by a rust also. In some seasons, on this account, scarcely any seeds are produced.

In our weed garden, grass garden and botanic garden proper, June grass causes us more trouble than any other weed. It is small for a time and escapes notice; the rootstocks improving the opportunity, and after a little we are obliged to root out considerable patches of cultivated plants to get rid of it. Couch grass is larger, less common and is more easily detected.

The failure of so many weeds to maintain their vigor where long kept in one spot, after all, is what we might expect, now that we think of it, for most of them have for many years been grown and pampered on the richest land and under good cultivation. There are some exceptions, among which are two or three fleabanes, ox-eye daisy and narrow dock.

Parasitic fungi take rank as weeds, when they attack our cultivated plants, but they are our friends when they attack weeds of the field and garden. A portion of our weed garden is given up to growing plants affected by parasites. Here is a patch of clover with the snaky dodder sucking the life from the stems, and near by is a barberry bush in the midst of a small patch of wheat; the bush sends spores to the wheat and from the old wheat straw spring spores to attack the barberry.

A sedge and a nettle are in like manner rendered obnoxious to each other by a rust. Last spring, to secure red cedars with the cedar apples that work on apple trees, producing rust on the leaves, our friend Dr. Halsted of New Jersey sent me some young red cedars containing good specimens of the coveted parasite. Near these are planted two young trees of red astrachan, little realizing the fate that awaits them next spring when the *Gymnosporangium* matures its teleutospores. Numerous other examples might be given, but these will serve to illustrate what has become a very attractive feature of our weed garden.

DONATIONS TO THE COLLEGE.

From A. O. Farwell, Detroit, Mich.:
12 kinds of seeds from India.

From G. H. Hicks, Washington, D. C.:
3 kinds of plants.

From Edgar Grimm, Portland, Oregon:
Leaves of red clover in form of cornucopiæ.

From A. A. Tylor, Easton, Penn.:
Seeds of Polygonum arifolium.

From E. L. Moseley, Sandusky, O.:
6 kinds of seeds.

From D. M. Andrews, Boulder, Colorado:
28 species of seeds of plants.

From W. F. Ganong, Northampton, Mass.:
114 kinds of seeds.

From Kew Gardens, England:
73 kinds of seeds.

From W. A. Burpee, Philadelphia, Pa.:
Seeds of Pink Cupid, Sweet Pea.

From C. E. Hollister, Laingsburg, Mich.:
A lot of seeds, mixed, of wild plants.

From Shaw Gardens, St. Louis, Mo.:
1 live plant.

From B. D. Halsted, New Brunswick, N. J.:
Live cedar trees affected with Gymnosporangium.

GIFTS TO OTHERS.

To University of Michigan:
48 kinds of shrubs and trees.
148 kinds of herbaceous plants.

To State Normal School:
87 kinds of plants.
36 kinds of seeds.

To Cornell University:
39 species of seeds of grasses.

To D. M. Andrews, Boulder, Colorado:
26 kinds of seeds.

Some exchanges have been made to increase our collections in the herbarium and in the botanic garden.

We have managed to double up and exchange work in a manner to permit Professor Wheeler to spend about two weeks at Institutes, and I was absent four weeks for this purpose.

I again tender my thanks to Professor C. F. Wheeler and to Instructor B. O. Longyear for valuable and faithful work and for their hearty co-operation in the interest of the department. I am exceedingly pleased with your hearty support ever since coming to M. A. C.

I am yours sincerely,

W. J. BEAL,

Professor of Botany and Forestry.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1897.

REPORT OF THE DEPARTMENT OF ZOOLOGY AND PHYSIOLOGY.

To the President:

SIR—I have the honor to submit the following report of the Department of Zoölogy, Physiology and Geology for the year ending June 30, 1897.

The classes which have received instruction in the department during the year were as follows:

	Students.
Sophomore Anatomy and Physiology, May to Aug., 1896	36
Sophomore Anatomy and Physiology, April to June, 1897	17
Junior Anatomy and Physiology, Sep. to Dec., 1896	30
Junior Entomology, May to Aug., 1896	24
Junior Entomology, April to June, 1897	27
Senior Entomology, May to Aug., 1896	6
Senior Entomology, April to June, 1897	3
Senior Zoölogy, Sep. to December., 1896	8
Senior Geology, Jan. to March, 1897	17
Total	168

As members of all these classes, with a single exception (geology), are required to do a large amount of laboratory work in addition to the class-room exercises, it will be seen that the time has been pretty well filled.

At the close of the fall term G. C. Davis, M. S., instructor in zoölogy since March, 1893, resigned his position in the department and removed to California on account of the failing health of his wife. While his withdrawal was deeply regretted, the College was fortunate in securing as his successor, Mr. Rufus H. Pettit, B. S. A., Cornell University, class of 1895, who for a year and a half had been serving as Assistant State Entomologist of Minnesota. Mr. Pettit has fully demonstrated his ability as an instructor and an entomologist, yet I desire to call attention to the fact that it is an utter impossibility for any one person, no matter how well qualified, to serve as instructor in entomology, zoölogy and anatomy, and as entomologist of the Experiment Station, and do justice to all the work of these positions. In my opinion it will be necessary very soon to separate the zoölogical work of the Experiment Station entirely from that of the College, the Station employing an entomologist who can give his entire attention to that work. It would seem perfectly obvious that a college department doing the work of instruction in the three separate sciences,—anatomy, zoölogy and geology, and making a specialty of entomology, cannot do justice to the students while nearly half the time of the professor and the single assistant must be given to Experiment Station work.

The equipment of the department has been materially improved during the year by the purchase of two more compound microscopes and a dissecting microscope, some lesser apparatus and accessories, and several books of reference and laboratory manuals. A good photo-micrographic outfit is very desirable and should be added as soon as the more pressing needs have been supplied.

The radical change in the College year, with a prospective summer vacation in place of the long winter vacation, has made the present year's work harder both for students and instructors, but it is not too soon to say that the results will be vastly better in the future, both in amount and character of work done, at least so far as this department is concerned.

Respectfully,

WALTER B. BARROWS,

Professor of Zoölogy and Physiology.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1897.

REPORT OF THE CURATOR OF GENERAL MUSEUM.

To the President:

SIR—I have the honor to submit the following report on the General Museum for the year ending June 30, 1897:

The condition of the collections remains about the same as last year, although the instalation of two new cases last year has allowed the rearrangement of the larger mammals and a more attractive display of the really fine specimens of these animals which until now were almost obscured by crowding. Several important additions to the collections have been made. The deer carcass presented last year by Mr. C. J. Davis of Lansing was sent to Rochester, N. Y., and the skeleton, beautifully mounted at an expense of $40, is now on exhibition. By purchase we also secured some very fine teeth and a few bones of a mastodon whose remains were found imbedded in a swamp at Eau Claire, Berrien county. Three of the molars are exceptionally well preserved, being almost as perfect and as compact as if taken from a freshly killed animal instead of having been buried in mud for thousands of years. Perhaps the most important single gift to the museum during the year is a collection of 46 bird skins presented by Mr. O. B. Wárren, formerly of Palmer, Marquette county, where these specimens were collected. All are well prepared skins of desirable species, and among them are several rare birds, two of these furnishing "first records" for the State.

In pursuance of a policy adopted when I first took charge of the Museum, it has been my aim to build up the biological collections so far as possible with specimens actually taken in Michigan, and purchases have been confined almost entirely to such examples. It doubtless will be several years before our collections of Michigan mammals, birds and reptiles will approach completeness, but each year some new species will be added, or some better examples of those already on hand. Of course donations of good specimens from any source are always gladly received.

The Museum is one of the strong attractions for visitors to the College, and its increasing popularity is indicated by the number of visitors. Not only do our own students and their friends visit the place frequently, but ever since the completion of the electric road to the College visitors from Lansing and "transients" from all parts of the State avail themselves of the opportunity to see the collection. The Museum is open daily, including Sundays, from 8 a. m. to 6 p. m.—or in winter until dark—and there is rarely a day when several visitors may not be found there at any time between these hours. It May, 1896, a register for visitors was opened in the Museum, and although no attendant has been left in charge of it, all visitors are requested to record their names, with place of residence and date of visit. Of course, however, many fail to comply with the request. During the past year, from July 1, 1896, to June 30, 1897, 4,830 names were entered on the register, and it was estimated that at least 2,500 more visitors failed to register. This would give an average daily attendance of at least 20, and indicates something of the utility of the Museum as a popular educator, while it is also certain that some visitors,

first attracted by the collections, have their attention directed afterward to other features of interest about the College, and so come to realize something of the magnitude of the institution and the opportunities for an education which are offered here.

The Museum is overcrowded with specimens and it is very desirable that more case room should be provided at once, not simply for the display of collections now kept necessarily stored out of sight, but in order to protect from deterioration other specimens which are now exposed to dust and possible vandalism. A commodious, fire-proof building for the Museum and Library is one of the most imperative needs of the institution, and I would urge most strenuously that no opportunity be lost of impressing this fact upon the State Board of Agriculture and upon members of the legislature.

I append a list of the principal accessions to the Museum during the past two years, the list for the year ending June 30, 1896, having been omitted by oversight from the report last year. Unless otherwise specified, the accessions are gifts.

LIST OF ACCESSIONS TO THE GENERAL MUSEUM.

July 1, 1895, to June 30, 1896.

J. H. Banghart—Three deer skulls from northern Michigan.

W. B. Barrows—Mounted catbird, skin of kingbird, skins of woodchuck and two chipmunks, young robin mounted, various young birds in alcohol, silvery bat *(Lasionycteris noctivagans)*, four snakes.

A. F. Bott—Skull of colt (hydrocephalic).

R. C. Bradley—Sections of alders cut by beaver.

B. F. Bush—Mycelium of fungus.

C. D. Butterfield—Spotted adder *(Ophibolus)*.

Leon J. Cole—Young water-snake *(Tropidonotus)*.

Chas. J. Davis—Carcass of deer for skeleton.

G. C. Davis—Specimens of silver ore from southern California.

Geology class of 1896—Two specimens of carboniferous fossils (Lepidodendrids) from Grand Ledge.

T. L. Hankinson—Two skins of black-throated bunting, skin of Philadelphia vireo, specimen of meadow-mouse *(Arvicola)*.

Mrs. F. W. Hunt, Lansing—Specimen of spider monkey *(Cebus sp.)* for skeleton.

Tod Kincaid, per I. H. Butterfield—Native gold in quartz, from Cripple Creek, Colo.

B. O. Longyear—Nest and eggs of black-throated bunting, specimen of fox-squirrel.

Eugene Maguire—Common weasel *(Putorius)*.

J. W. Rigterink—Red-winged blackbird.

E. D. Sanderson—About 80 specimens of minerals and fossils (exchange).

Percy E. Selous, Greenville—Nine specimens of mounted birds, one mammal (skunk), 18 skulls of various kinds (purchased); two mounted specimens of pied-billed grebe (gift).

W. C. Stewart—Red-bellied woodpecker.

C. H. VanAuken—Little black bat *(Vespertilio gryphus)*.

George H. Warren, Flint—Two hundred birds' eggs, representing 85 species.

L. Whitney Watkins, Manchester—Four specimens of chipping sparrow, skins, immature.

A. H. Whitehead, Lansing—Barnacles from sea tortoise (Florida).

July 1, 1896, to June 30, 1897.

W. B. Barrows—Sixteen specimens in alcohol of mammals, birds, reptiles, and fish; 1 mole skull, 2 birds' skulls.

Dr. W. J. Beal—Cast skin of snake; specimen of red squirrel with white tail.

C. S. Brooks—Plymouth Rock fowl, for skeleton.

O S. Burcham—American bittern *(Botaurus)*.

O. P. Chapin, Ribble, Mich.—Albino kingbird *(Tyrannus tyrannus)*.

Leon J. Cole and T. L. Hankinson—Massasauga *(Sistrurus catennatus)*, young Carolina grebe.

B. L. Comstock, Eau Claire, Mich.—Part of lower jaw of mastodon, with six molars, fragments of tusk, and a few pieces of other bones, exhumed at Eau Claire. (Purchased.)

Prof. A. A. Crozier—Mexican "quirt."

Edward A. Gilkey, Lansing—Eight-legged kitten.

T. L. Hankinson—Short-tailed shrew, white-footed mouse, and Baird's sandpiper.

Richard Harrison—Mole *(Scalops aquaticus)*.

B. O. Longyear—Ten specimens of fossils and polished rocks; imperfect skeleton of very large snapping turtle *(Chelydra serpentina)*; young tortoise *(Chrysemys)*; 2 young chimney swifts.

W. A. Oldfield, Port Sanilac—Great northern diver or loon, and horned grebe *(Colymbus auritus)*.

E. D. Sanderson—Fifteen skins of small mammals (exchange), set of 3 marsh hawk's eggs.

Percy E. Selous, Greenville—Six specimens of mounted birds, viz.: northern raven, hawk owl, marsh hawk, pair black-backed woodpeckers, Canada goose. (Purchased.)

R. H. Stocoum—Silk "cap" or web from Belding silk mill.

Oscar B. Warren, Hibbing, Minn.—Collection of 46 bird skins, including several rare species and two new to the State, all collected in Marquette county, Mich.

O. P. West—Red bat *(Atalapha noveboracensis)*.

Prof. C. F. Wheeler—Large specimen of horse-shoe crab, from Atlantic coast; nest of paper wasp *(Vespa maculata)*; very large larva of scaraboeid beetle.

Respectfully,

WALTER B. BARROWS,

Curator of General Museum.

Agricultural College, Mich.,

June 30, 1897.

REPORT OF THE DEPARTMENT OF MATHEMATICS AND CIVIL ENGINEERING.

To the President:

SIR—The report of this department which was made last year included a period ending with the summer term of 1896, hence extending somewhat beyond the close of the fiscal year 1895-96. Accordingly, this report will deal only with the record of the three terms of the College year just past.

There has been no change in the instructing force engaged in the work of the department. Assistant Professor W. Babcock and Instructor C. C. Pashby have continued to discharge faithfully and efficiently the duties of their respective positions. That these duties have been no less arduous this year than last is clearly shown in the tabulation given below. A comparison of this table with the one in my last report shows that the aggregate attendance in all classes of the department has increased from 425 in the college year 1895-96, to 513 in the year 1896-97, an increase of more than 20 per cent.

INSTRUCTION.

During the three terms covered by this report we have met classes as shown in the following statement, which also indicates the instructor in charge of each and the number of students enrolled in the department each term.

Fall term, 1896—Seniors, one class in graphic statics, Mr. Pashby. Juniors, one class in integral calculus, Assistant Professor Babcock; and one class in surveying, with afternoon practice in the field, Professor Vedder. Sophomores, one class in trigonometry, Professor Vedder; and one class in solid geometry, Assistant Professor Babcock. Freshmen, three classes in algebra; one for mechanical students, commencing with the subject of quadratics, in charge of Assistant Professor Babcock, and two for agricultural students, beginning the study of algebra, in charge of Mr. Pashby. Total enrollment for the Fall term, in all regular classes, 175.

Winter term, 1897—Seniors, one class in hydraulics, Professor Vedder. Juniors, one class in mechanics of engineering, Professor Vedder. Sophomores, one class in analytic geometry, Assistant Professor Babcock. Freshmen, one class in algebra, second term's work for mechanical students, Assistant Professor Babcock; two classes in algebra, second term's work for agricultural students, Mr. Pashby; and two classes in plane geometry, Assistant Professor Babcock and Mr. Pashby. Total enrollment in regular classes for the Winter term, 175.

Spring term, 1897—Seniors, one class in civil engineering with afternoon field practice, Prof. Vedder. Juniors, one class in mechanics of engineering, Professor Vedder. Sophomores, one class in differential calculus, Assistant Professor Babcock; one class in plane trigonometry, Mr. Pashby, and one class in surveying with afternoon field practice, Professor

Vedder. Freshmen, two classes in plane geometry, Assistant Professor Babcock and Mr. Pashby; and two classes in solid geometry, Assistant Professor Babcock and Mr. Pashby. Total enrollment for the Spring term, 163.

In addition to the regular class work as above scheduled, we have given special instruction in such subjects as lettering, colored topography and other civil engineering drawing. Mr. Pashby assisted me in caring for the afternoon field practice in surveying, although not regularly assigned to that work. All teachers in the department have been called upon to give special instruction in practical surveying, on Saturdays and at other times.

About 100 special examinations have been given and reported during the year, a smaller number, I believe, than for any similar period since I took charge of the department. This number does not include examinations taken at entrance, but only those to make up back work. The unusually small number of special examinations would, therefore, seem to indicate better success in the regular class examinations,—an inference which I hope may prove to be a fact.

In accordance with my custom in earlier reports, I have prepared the following table, which exhibits in convenient form for reference the totals of the above class record, and some other points that may be called in question:

Class work of the department of mathematics and civil engineering for the college year 1896-97.

Class.	Subject.	Term.	No. of divisions.	No. of hours per week for each division.	Total No. of hours per week for the class.	No. of students enrolled.
Freshmen	Algebra	Fall	3	5	15	102
"	"	Winter	3	5	15	109
"	Geometry	"	2	5	10	42
"	"	Spring	4	5	20	88
Sophomores	Trigonometry	Fall	1	5	5	20
"	Geometry	"	1	5	5	29
"	Analytic Geometry.	Winter	1	5	5	17
"	Trigonometry	Spring	1	3	3	27
"	Surveying	"	1	4	4	20
"	Dif. Calculus	"	1	5	5	16
Juniors	Surveying	Fall	1	4	4	7
"	Int. Calculus	"	1	5	5	9
"	Mechanics	Winter	1	5	5	7
"	"	Spring	1	5	5	6
Seniors	Graphics	Fall	1	3	3	7
"	Hydaulics	Winter	1	5	5	1
"	Civil Engineering	Spring	1	6	6	6
Totals			24		120	513

Our classes have used as text-books the following:

Van Velzer & Slichter's School Algebra for agricultural students, Van Velzer & Slichter's University Algebra for mechanical students, Beman & Smith's Geometry, Wentworth's Trigonometry for the Fall term class, Jones' Trigonometry for the Spring term class, Wentworth's Analytic Geometry, Rice & Johnson's Calculus, Church's Mechanics, Hodgman's

Manual of Land surveying, Merriman & Jacoby's Graphic Statics, and Johnson's Theory and Practice of Surveying.

This list is given simply for convenience of future reference, and is not to indicate that our methods of instruction hold rigidly to the lines of any particular text. Much of the instruction is given by lectures, and frequent references are made to other texts than those which form the bases of our courses.

EQUIPMENT.

The expenditures of the fiscal year for supplies, instruments, etc., purchased for the department, aggregate $370.35. The most important item of this amount is one of $284.25, paid to Buff & Berger of Boston for a new engineer's transit and a solar attachment for the same. This purchase follows a recommendation of my last year's report. The instruments are of the best, are much appreciated by the department and I am sure will prove to be additions wisely made. A new carpet has been provided for the office and new window shades for class-rooms B and C. A sewer computer has been added to our instrumental outfit. The supplies used in field and class work, stationery, a few small tools, and postage, complete the list of purchases made, and make up the total above given.

The inventory for this year of property belonging to this department, including instrumental equipment, observatory, office and class-room furniture, shows an aggregate value on June 30 of $3,969.98, against $3,643.13 for last year.

SURVEYS, RECOMMENDATIONS, ETC.

No extensive surveys have been called for during the year, and our work in practical engineering has been limited to the extension of a few sewer service laterals to residences, to the veterinary laboratory and to the library. Some time has been spent in surveying portions of the campus and in accurately determining the west farm line.

I would suggest the advisability of making provision for more regular inspection and cleaning of the sewers on the campus. Except for a clogging by tree roots in April, 1896, the main sewer system laid in 1893 has continued to work automatically. But it can hardly be expected to do so indefinitely, and periodic inspection may locate obstructions before they become difficult of removal.

Allow me to urge the early installation of sanitary conveniences at College Hall. The change of the terms of the College year, resulting in long sessions in class-rooms during the winter months, makes necessary some provision of this kind. A sewer lateral already extends to the building.

During the winter term I attended Farmers' Institutes at Stockbridge, Chelsea, Laingsburg, Chesaning, Emmett, Croswell and Bad Axe, and gave talks on "Highway Bridges and Culverts."

Throughout the year student sentiment has been filled with a spirit of industry, so far as this department is concerned. The relations between teachers and students have been uniformly pleasant ones.

Respectfully submitted,

H. K. VEDDER,

Professor of Mathematics and Civil Engineering.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1897.

REPORT OF THE DEPARTMENT OF PHYSICS.

President Snyder:

Dear Sir—I have the honor to submit my report for the Department of Physics and Electrical Engineering for the year ending June 30, 1897. The purchase of several minor pieces of apparatus, together with some changes in the arrangement of the rooms used for laboratory work, have made it possible to improve the academic work very much. Placing the work in physics in the early parts of all courses I believe is proving a wise step. While it is not possible to do as advanced work as formerly, yet it places before all students at the very beginning the fundamental principles upon which all our courses are established. My work is quite evenly spread out over the year. Upon the basis of all students in College for the past year, a fraction over 8 per cent of total student class hours have been in my personal charge.

I had the pleasure of delivering four lectures at the Fruit Institute at Shelby.

The first part of the past year there was completed under my supervision installation of quite a complete telephone system by the Lansing Telephone Co. An agreement was made between Mr. D. A. Reynolds, manager of and acting for the Lansing Telephone Co., and Sec. I. H. Butterfield, acting for the State Board of Agriculture, essentially as follows: The Lansing Telephone Co. was given the privilege of placing telephones in the College buildings, said privilege to be terminated at any time by the State Board of Agriculture or their agents, the Lansing Telephone Co. agreeing that all wires were to be strung and all poles to be set subject to my approval. In return for the privilege the Lansing Telephone Co. agreed that all wires and poles complete placed on the grounds of the Michigan Agricultural College became the property of the State Board of Agriculture as soon as placed.

Acting upon your suggestions, I have been working on plans and estimates for a College electric light and power plant.

Most respectfully submitted,

PHILIP D. WOODWORTH.

REPORT OF THE DEPARTMENT OF DRAWING.

To the President:

SIR—The following is the report of the Department of Drawing for the year 1895-96:

AUTUMN TERM, 1895.

Freshmen Mechanicals in Mechanical Drawing: Two hours per day, five days per week—ten hours.

Sophomore Mechanicals in Descriptive Geometry: Two hours per day, three days per week—six hours.

WINTER TERM, 1896.

Freshman Agriculturals in Free-hand Drawing: Two divisions, two hours each, five times per week—twenty hours.

Freshman Mechanicals, Machine Sketching: Two hours, three days per week—six hours.

SPRING TERM. 1896.

Freshman Mechanicals in Descriptive Geometry: Two divisions, one hour each, five days per week—ten hours.

Faithfully,

W. S. HOLDSWORTH.

WOMEN'S COURSE.

DEPARTMENT OF DOMESTIC SCIENCE.

To the President:

DEAR SIR—The following report of the work done in the Domestic Science Department, with suggestions regarding its needs, is respectfully submitted:

The Domestic Science Department opened September fourteenth, eighteen hundred ninety-six, with thirty-nine regular and seven special students in attendance.

The rooms in which the work is carried on are well lighted and fully equipped with such appliances and utensils as are found necessary in preparing food for the table.

There is great need for a suitable dining room, and rooms in which the lectures in household economy can be given.

As the course is now arranged, cooking is taught during the freshman year and two terms during the senior year. The instruction in sewing extends through the sophomore year and two terms in the junior year. Lec-

tures in household economy, hygiene and home nursing are given during the sophomore year. One term is also devoted to millinery.

Up to this date three terms of cooking have been completed. The following is an outline of the work: Talk on cookery, definition of terms, objects of cookery, to make food more palatable, more digestible, and the destruction of germs. The necessity of cookery, to render food in fit condition for the body the application of artificial heat is necessary. Kinds of fuel, building of fire, construction of range, care of waste material, drainage, measurements, illustrations of dry and moist heat in practical work.

The fundamental principles relating to the subjects; namely: water, mineral matter, carbohydrates, fats and oils, proteids, food adjuncts—definition and explanation of these terms. Various uses and necessity of each principle for the health of the body.

Beginning with starch—source, kinds, composition, effect of hot and cold water, dietetic value, test for starch—illustrated by practical work.

Each principle is thus expounded by means of practical work, illustrating the theory of the subject.

The first work includes the preparation of the simpler dishes, such as vegetables, cereals, eggs, milk, cheese dishes, cooking in deep fat, meats, soups, bread, pastry, cake, baking powder mixtures, beverages, ices, etc., followed by canning, preserving, the preparation of jellies, pickling, and the more complicated dishes. Special lessons are given in invalid cookery. An animal is cut up before the class to teach the various cuts of meat as found in the market.

Each student is required to write full essays on the various kinds of food, also to prepare twenty-five and fifty-cent dinners for a family of six. The correct method of serving more elaborate breakfasts, luncheons and dinners.

Special attention is also given to the care of the kitchen, store-room, etc.

The students cooked and served dinner and luncheons to the State Board and members of the Faculty. Also the Triennial Banquet, June fifteenth, at which three hundred guests were served.

The following is a tabulated account of expenses since the department opened:

Student labor	$42 49
Washing	9 25
Other labor	1 25
Provisions	72 78
Equipment	465 50
Printing	79 60
Stationery	7 60
Expressage	6 29
Total	$784 76

The following course of study is pursued by young women—the number after each subject indicates the number of hours spent either in the class room or laboratory:

FRESHMAN YEAR.

Fall Term—Algebra, 5. Botany, 7½. Calisthenics, 3. Cooking, 4. English, 5. Mechanics, 2. Rhetoricals, 2. *Music, 1. Music Practice, 5.

*Two year's instruction on the piano without charge.

Winter term—Algebra, 5. Botany, 2. Calisthenics, 3. Drawing, 10. Cooking, 4. English, 2. Physics, 4. Music, 1. Music Practice, 5.

Spring Term—Calisthenics, 3. Cooking, 4. English, 2. English History, 5. Geometry, 5. Physics, 4. Music, 1. Music Practice, 5.

SOPHOMORE YEAR.

Fall Term—Anatomy, 2, and Laboratory, 1. Calisthenics, 3. Drawing, 4. Elementary Chemistry, 5, and Laboratory, 2. English, 2. Geometry, 5. Household Economy, 1. Sewing, 4. Music, 1. Music practice, 5.

Winter Term—Analytical Chemistry, 10. Calisthenics, 3. Drawing, 2. English, 1. Household Economy, 1. Physics, 3, and Laboratory, 4. Physiology, 4, and Laboratory, 2. Sewing, 4. Music, 1. Music Practice, 5.

Spring Term—Botany, 7. Calisthenics, 3. Drawing, 3. English, 2. General History, 5. Household Economy, 1. Landscape Gardening—half term, 5. Sewing, 4. Vegetable Gardening—half term, 5. Music, 1. Music Practice, 5.

JUNIOR YEAR.

Fall Term—Calisthenics, 3. German, 5. Graphic Arts, 2. Logic, 5. Organic Chemistry, 5. Pomology, 5, and Laboratory, 4. Sewing, 4.

Winter Term—Art Needle Work, 4. Calisthenics, 3. Civics, 4. Floriculture, 5, and Laboratory, 4. German, 5. Rhetorical Analysis, 5. Shakespeare, 1.

Spring Term—Calisthenics, 3. Dramatic Interpretation, 3. English Language and Literature, 5. German, 5. History of Art, 5.. Millinery, 4. Shakespeare, 2. Trees and Shrubs, 3.

SENIOR YEAR.

[Three electives required and one industrial subject.]

Fall Term Electives—Agriculture, 5. Horticulture, 5. Meterology, 5. Bacteriology, 7. Physics, 5. Constitutional History, 5. German, 5. French, 5. Floriculture, or Pomology, or Kitchen Gardening.

Winter Term Electives—Agriculture, 5. Horticulture, 5. Economic Zoology, 5. English Masterpieces, 5. Psychology, 5. German, 5. French, 5. Dairying, or Floriculture, or Pomology.

Spring Term Electives—Agriculture, 5. Horticulture, 5. Political Economy, 5. Geology, 5. Agricultural Engineering, 5. German, 5. French, 5. Floriculture, or Pomology, or Kitchen Gardening, or Poultry Raising.

EDITH F. McDERMOTT.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1897.

REPORT OF THE LIBRARIAN.

To the President:

SIR—I have the honor to present the following report on the library, for the year ending June 30, 1897:

During the year 440 bound volumes have been added, of which 329 were purchased, 60 donated, and 51 by binding. From the following, bound volumes have been received:

American Short-horn Herd Book, vol. 40.
American Shropshire Sheep Record, vol. 11.
American Cotswold Record, vol. 7.
Butterfield, K. L. Michigan Farmers' Institutes, Bulletin No. 2.
Georgia, Department of Agriculture, Report 1896.
Heliostat, the. Junior class. 1897. Three copies.
Illinois, Department of Agriculture. Trans. 1895.
Lintner, J. A. "Injurious Insects of N. Y.", 10th, 11th reports.
Leonard, G. C. "Cap and Gown in America."
Massachusetts, Board of Agriculture. "The Gypsy Moth."
Maine, "Vital Statistics." 2d report.
McCormick, Cyrus. "Inventors."
Meadville, (Pa.), Theol. School. "Christianity and Social Problems."
Michigan. "Laying of the Corner-stone of the New Capitol."
Michigan Dairymen's Association, 11th annnal report.
  Board of Agriculture, Report 1894-5.
  State Medical Society, Trans., 1896.
  Labor Commissioner, 14th annual report.
  Labor Bureau. "Vital Statistics." 28th annual report.
  Labor Bureau. "Factory Inspection." 4th annual report.
  Board of Corrections and Charities, 13th biennal report.
  Board of Health, 22d annual report.
  Horticultural Society, Report 1895.
  Local Acts, 1889.
Nebraska Horticultural Society, Report 1894.
Parsons, Miller & Steward, "Invention of Reaping Machines."
Rhode Island Board of Agriculture, 11th report.
Smyth, B. B. Kansas Acad. of Science. Trans. vol. 14.
Smithsonian Institution, Report 1895.
  Report 1894, U. S. Nat. Museum, 2 vol.
  Proc. U. S Nat. Museum, 1895.
  Bureau of Ethnology, 13th report.
  Contributions to knowledge, 3 vols.
Stokes, A. P. "Joint Metalism."
United States:
  Department of Agriculture. Report 1893-4.
  Census Bureau. 6 vols.
  Bureau of Education. 2 vols.
  Labor Bureau. "Strikes and Lock-outs."
  Labor Bureau, 8th special report.
  Navy Department. Washington Observations, 1890.
  Navy Record, U. S. and Confedeiate Navies, 2 vols.
  Navy American Ephemeris, 1899.
  Coast and Geod. Survey, Report 1895.
  War Department. Rebellion Records. 2 vols.
  War Department. Chief of Engineers. Report 1896. 6 vols.
  Interstate Commerce Commission, Statistics of R. R., 1895.
  Notes on mitering lock gates.
  Certain climatic features of the two Dakotas.

The following pamphlets and unbound volumes have been received:

Australia, 13.
American Economic Association. "Studies."
American Museum of Natural History, Bulletin No. 8.
  Report 1896.
American Short Horn Breeders' Association. Circulars.
American Statistical Association. 1.
"Annexation of Hawaii." 2 copies.
Bandholtz, Lieut. H. "Manual of Military Signaling."
Crozier, A. A. To California and Back."
  Photographs of views in Mexico.
  Production of grain, etc., in Argentine Republic, in 1895-6.
Canada. Entomological Society of Ontario, Report 1896.
  Dairymen & Creameries' Association, Report 1895.
  Superintendent of Farmers' Institutes, Report 1895-6.
  Geol. Survey. Maps to accompany Report 1897.
  Ontario Live Stock Association. Report 1895-6.
  Experimental Farms, Report 1895.
  Clerk of Forestry, Report 1896.
  Canadian Institute, Trans., vol. 5, pt. 1.
  Proc., vol. 5, N. S., pt. 2.
California Acad. of Science, Proc., vol. 6, 1896.
California Viticultural Soc., "Resistant vines."
Colorado College, studies, vol. 6.
Cincinnati House of Refuge, Report, 1895.
Cincinnati Soc. Nat. History, Journal; vol 19, part 1.
Detroit Museum of Art, 1.
Draper, D. N. Y. Meteorology.
Dabney, C. W. The national university.
Dabney, C. W. A national department of science.
Elisha Mitchell Scientific Society, 2.
Essex Institute, 3.
France, Ministére de l'Agriculture. Bulletins, 7.
  Bulletin des séances de la Soc. d'Agri. 10.
Field Columbian Museum, Report 1896.
  Publications, 1.
Grand Rapids Public Library, Report of Committee, 1895-6.
Harvard University, Report of President and Treasurer, 1895-6
  Bussey Institution, Bulletin, vol. 2, part 5.
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Minnesota Academy of Natural Sciences, 1.
Massachusetts Board of Agriculture. Farmers' Institutes, Regulations, 1896.
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Mexico, 10.
Michigan Reports:
  State Board of Health, 2.
  Supt. Public Instruction, 2.
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  Political Science Association, 3.
N, Y. Botanical Gardens, 2.
N. Zealand, Agricultural Report, 1896.
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Nebraska, Report, Soldiers' and Sailors' Home, 1896.
Newberry Library, Report of Trustees, 1895.
Nova Scotia, Institute of Science, Proc. and Trans., vol. 9, part 2.
N. S. Wales, "Insectivorous Birds."

Ohio, State Agricultural Convention, Proc., 1897.
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Sound Currency Com., Legal-tender system.
World's experience of Government paper money.
Smithsonian Institution, 13.
Squibbs, E. R., Ephemeris of materia medica, vol. 4, part 5.
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Library Bulletins.
Weather Bureau Bulletins, 13.
Bureau American Republics, 3.
Bureau Education, 4.
Labor Bureau, 6.
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Inter-state Commerce Commission, 2.
Interior Department, 1.
Patent Office, 3.
State Department, 14.
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Strike Commission, Report, 1894.
Vermont, Board of Agribulture, Report of Cattle Commissioner, 1896.

In the reading room are the following publications:

FOREIGN.

Analyst.
Agricultural Gazette.
Annals of Botany.
Annales de l'Institut de Pasteur.
Blackwood's Magazine.
Biedermann's Centralblatt.
Botanisches Centralblatt.
Chemical News.
Centralblatt Bakterologie, Erste Abteilung.
" " Zweite "
Electrician.
Engineering.
Edinburgh Review.
Entomologist.
Entomologist's Monthly Magazine.
Garden.
Gardeners' Chronicle.
Hygiene Rundschau.
Journal Royal Agricultural Society.
Horticulture.
Journal Anatomy and Physiology.
Chemical Society.
Society of Chemical Industry.
Royal Microscopical Society.
Kew Bulletins.
Lancet.
La Laiterie.
Die Landwirtschaftliche Jahrbücher.
Die Landwirtschaftlichen Versuchs-Stationen.
Magazine of Art.
Milch Zeitung.
MacMillan.
Revue Horticole.
Revue General de Botanique.
Veterinarian.
Veterinary J'l.
Westminster Review.
Zeitzschrift für Hygiene.

AMERICAN.

American Entomological Society.
Florist.
Sheepbreeder.
Agriculturist.
Cheesemaker.
Cultivator.
Gardening.
Chemical Journal.
Veterinary Review.
J'l. of Science.
Microsc. J'l.
Naturalist.
Machinist.
Engineer, Car builder, and R. R. Journal.
Kitchen Magazine.
Annals of Amer. Acad. of Polit. Science.
Art Amateur.
Atlantic.
Annals of Mathematics.
Auk. The.
Boston Soc. of Nat. History.
Breeders' Gazette.
Botanical Gazette.
Bulletin Torrey Botanical Club.
Chicago Inter-Ocean, daily.
Century.
Country Gentleman.
Contemporary Review.
Cosmopolitan.
Critic.
Canadian Entomologist.

Cassier's Magazine.
Cumulative Index.
Detroit Free Press, daily.
Detroit Tribune, daily.
Delineator.
Drainage Journal.
Entomological News.
Engineering Mag.
Mechanics.
Educational Review.
Economics Quarterly.
Engineering News.
Farmers' Review.
Forum.
Fortnightly.
Gardening.
Harper's Monthly.
Weekly.
Irrigation Age.
J'l of Applied Microscopy.
Franklin Institute.
Ass'n of Engineering Societies.
Experimental Medicine.
Johns Hopkins Univ. Studies.
Circulars.
Ladies' Home J'l.
Library J'l.
Literary World.
Living Age.
Mich. Farmer.
Mich. Fancier.
Mechan's Monthly.
Microscope.
Nation.
Nature.
Nineteenth Century.
N. Amer. Review.
Ohio Farmer.
Outlook.
Political Sci. Quarterly.
Prairie Farmer.
Psyche.
Power.
Physical Review.
Popular Sci. Monthly.
Proc. Acad. of Nat. Sciences.
Pub. Amer. Economic Ass'n.
Quarterly Review.
Rural New Yorker.
Southern Cultivator.
Science.
Scribner.
Scientific Amer.
Supp.
Vick's Monthly.

Through the courtesy of publishers, or in exchange for college publications, we also receive the following:

Amer. Society of Civil Engineers, Proc.
Adrian Times.
Albion Recorder.
Allegan Gazette.
American Missionary.
Swineherd.
Horsebreeder.
Creamery.
Horticulturist.
Bee Keeper.
Phil. Society Proceedings.
Agricultural Epitomist.
Ann Arbor Democrat.
Bee Gleanings.
Baltimore Sun.
Battle Creek Journal.
Boyne Citizen.
Church Helper.
Corn Belt.
Copemish Courier.
Christian Register.
Clinton Independent.
Chesaning Record.
Chicago Produce.
Detroit Twice-a-week Free Press.
Evening News, Saginaw, daily.
Elgin Dairy Record.
Farmer's Voice.
Farming.
Farm, Field and Fireside.
Farmer's Advocate.
Home.
Guide.
Journal.
Fruit Growers' Journal.
Good Health.
Grand Traverse Herald.
Grand Rapids Democrat.
Herald.
Homestead.
Hillsdale Leader.
Standard.
Home Companion.
Hoard's Dairyman.
Home and Farm.
Indiana Farmer.
Industrial American.
Industrialist.
Ingham County News.
Ionia Sentinel.
Jonesville Independent.
Journal d' Agriculture.
Journal N. Y. Microscopical Soc.
Jackson Patriot.
Kalamazoo Telegraph.
Land of Sunshine.
Lansing Journal.
Review.
Literary News.
Ludington Recorder.
Michigan Fruit Grower.
Marine City Magnet.
Monthly Weather Review.
Mail and Times.
Midland Republican.
Mirror and Farmer.
Moderator.
Michigan Mirror.
Montcalm Herald.
McBain Chronicle.

Market Garden.
New Ideas.
New England Florist.
New York Weekly Witness.
Onekema Lake Breeze.
Orange Judd Farmer.
Official Gazette.
Public Ledger, Phila., daily.
Pacific Coast Dairyman.
Pratt Institute Monthly.
Practical Farmer.
Park's Floral Magazine.
Pennsylvanian.
Southern Farmer.
Saginaw Courier-Herald.
State Republican.
Sault Ste. Marie News.
Soo Democrat.
Sugar Beet.
St. Ignace News.
 Enterprise.
Salt Lake Herald.
Southern States.
Sound Currency.
Toledo News.
Travelers' Record.
Traverse Bay Eagle.
Timely Topics.
Western Agriculturist.
 Plowman.
Wolverine Citizen.
Wallace Farmer.
Western Society of Engineers.
Williamston Enterprise.
Western Rural.
Ypsilantian.
Also M. A. C. Record exchanges.

The library numbers about 20,000 bound volumes, and is open to students 11 hours each day except Sunday, the hours on that day being from 9 to 12 a. m.

Five thousand and four books have been loaned during the year, an excess of 484 volumes over the previous year. No record is kept of the large number of books used in the library. The librarian has been assisted in her work by Miss Amy B. Vaughn, and Mr. T. C. Lewis, both of whom have performed their duties in a manner highly creditable to themselves, and to the entire satisfaction of all concerned.

The Experiment Station library has grown but slowly during the year. 43 books have been added; 36 by binding, 4 by purchase, and 3 by gift. Of the periodicals mentioned in this report, 15 are purchased by the Experiment Station. The bulletins issued by the various stations are received, as are also the publications of the U. S. Department of Agriculture.

Respectfully submitted,
LINDA E. LANDON,
Librarian.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1897.

TENTH ANNUAL REPORT

OF THE

EXPERIMENT STATION

OF THE

STATE AGRICULTURAL COLLEGE OF MICHIGAN

UNDER THE HATCH ACT

FOR THE

YEAR ENDING JUNE 30, 1897

For members and organization of the State Board of Agriculture in charge of the Station, and list of officers, see pp. 4 and 5 of this volume

EXPERIMENT STATION.

REPORT OF SECRETARY AND TREASURER.

The following account shows the receipts and expenditures of the Experiment Station for the year ending June 30, 1897:

July 1, 1896—To balance on hand		$3,081 64	
July 9, 1896	received from U. S. Treasury	3,750 00	
Oct. 8, 1896	received from U. S. Treasury	3,750 00	
Jan. 7, 1897	received from U. S. Treasury	3,750 00	
April 8, 1897	received from U. S. Treasury	3,750 00	
June 30, 1897	license fees on 61 brands commercial fertilizers	1,220 00	
	miscellaneous receipts, mostly farm products	282 41	
June 30, 1897—By disbursements as per vouchers filed in the office of the State Auditor General		....	$16,804 93
July 1, 1897	balance on hand	....	2,779 12
		$19,584 05	$19,584 05

Thirty thousand copies of station bulletins are now issued and the demand is increasing as farmers learn of their value. Several press bulletins have been issued and special information in bulletin form has been sent out by the station.

DISBURSEMENTS ON ACCOUNT OF U. S. APPROPRIATION.

Salaries:		
Director and administrative officers	$1,600 00	
Scientific staff	4,202 78	
Assistants to scientific staff	4,199 92	
Special and temporary services	148 94	
		$10,151 64
Labor:		
Monthly employés, two, average rate, $32.00	$926 37	
Daily employés, 500 days, average rate, $1.37½	145 32	
Hourly	530 18	
		1,601 87
Chemical supplies:		
Chemicals	$329 96	
Other supplies	87 77	
		417 73
Publications, envelopes, cuts, etc.	$125 84	
		125 84

Seeds, plants, and sundry supplies:		
Agricultural	$103 68	
Horticultural	267 44	
Entomological	8 34	
Miscellaneous	45 49	
		$424 95
Tools, implements and machinery:		
Repairs	$6 60	
New purchases	69 15	
		75 75
Furniture and fixtures:		
12 cages for Guinea pigs	$24 00	
50 cages for Guinea pigs	100 00	
1 steam fertilizer	8 00	
1 hot air fertilizer	9 00	
1 case for botanical specimens	14 00	
1 case for chemical laboratory	12 44	
1 large case for chemical laboratory	37 00	
Sundry small fixtures	22 00	
		226 44
Scientific apparatus:		
6 Wiley's extraction apparatus	$22 50	
4 chloride calcium tubes	4 00	
1 set re-agent bottles	7 17	
2 balances	33 25	
1 Koch burner	12 00	
1 incubator, bacteriological	87 00	
1 sand filter	9 30	
1 viscometer	20 00	
Sundry small apparatus	31 65	
		226 87
Live stock:		
Swine	$11 50	
Sundries	21 70	
		33 20
Traveling expenses:		
In supervision of station work	$110 34	
In attending farmers' institutes and other meetings	74 61	
		184 95
Contingent expenses	$11 50	
		11 50
Building and repairs:		
Barn for fodder stuffs	$641 03	
Side hill forcing house repairs	8 69	
		649 72
Postage and stationery		134 55
Freight and express		164 88
Fertilizers		100 48
Feeding stuffs		308 84
Library		160 79
Total		$15,000 00

DISBURSEMENTS OF EXPERIMENT STATION--MONEYS OTHER THAN RECEIVED FROM UNITED STATES TREASURER.

Labor	$1,036 49	
Publications	2 00	
Postage and stationery	1 25	
Taxes and rent of land	148 09	
Seeds, plants and sundry supplies	22 35	
Fertilizers	9 23	
Tools, implements and machinery	15 00	
Live stock, team, furniture and fixtures	224 15	
Traveling expenses	68 16	
Building and repairs	268 61	
Scientific apparatus	1 50	
Contingent expenses	8 10	
		$1,804 93
Balance on hand		2,779 12
Total		$4,584 05

SUMMARY OF TOTAL DISBURSEMENTS—CLASSIFIED FOR DEPARTMENTS.

Buildings and repairs to buildings	$1,154 85
Library	157 79
Farm	2,471 06
Garden	649 37
Chemical	449 36
Botanical	29 06
Zoölogical	75 65
Veterinarian	735 31
South Haven Station	1,971 10
Salaries	8,202 58
Apiary	504 59
Office	294 00
Sundry	110 21
Total	$16,804 93

DIRECTOR'S REPORT

Agricultural College, Mich., May 21, 1898.

President Snyder:

I herewith hand you my report as Director of the Experiment Station for the year ending Nov. 1, 1897. This report contains besides my formal report, the following documents: The reports of the Agriculturist, of the Horticulturist, of the Consulting Botanist, of the Consulting Entomologist, of the Assistant Bacteriologist, of the Consulting Veterinarian, of the Apiarist, and a supplementary report from J. M. Rankin, with a copy of each of the bulletins issued from July 1, 1896, to June 30, 1897.

Respectfully yours,

CLINTON D. SMITH,

Director and Agriculturist.

REPORT OF THE DIRECTOR.

To the President:

I have the honor to submit herewith my annual report for the year extending to Nov. 1, 1897.*

There has been issued to June 30, 1897, the following bulletins:

No.	Title.	Author.	Department.	Pages.
135	Fertilizer Analyses	R. C. Kedzie	Chemical	15
136	Fattening Lambs	H. W. Mumford	Farm	25
137	Feeding Corn Smut	C. D. Smith	Farm	6
138	Feeding Pigs	C. D. Smith	Farm	56
139	Bacteria	C. E. Marshall	Veterinary	58
140	Ropiness in Milk	C. E. Marshall	Veterinary	18
141	Forage Crops and Wheat	A. A. Crozier	Farm	37
142	Fruit Tests	L. R. Taft and H. P. Gladden	Hort'l	18
143	Fruits at South Haven	T. T. Lyon	Hort'l	44
144	Vegetables, Old and New	L. R. Taft, H. P. Gladden and M. L. Dean	Hort'l	87

The year covered by this report has been marked by three important changes in the working force of the Station. Dr. E. A. A. Grange, the Consulting Veterinarian, under whose wise and energetic administration the Veterinary Department of the College had attained a high degree of excellence, and made for the College a good reputation in that line of work, was called to an influential position in Detroit in August. He was succeeded by Dr. G. A. Waterman, a graduate of the Michigan Agricultural College, who had been for several years the Professor of Veterinary Science at Storrs Agricultural College, Conn. His work with us began in the latter part of September.

On account of sickness in his family, Mr. Gager C. Davis, the Consulting Entomologist of the Station, resigned his position and removed to California. Dr. W. B. Barrows, Professor of Zoölogy and Physiology in the College, was appointed his successor. Prof. R. H. Pettit was called from the Minnesota Experiment Station to be his assistant.

At the close of the fiscal year the bees were moved from the home of R. L. Taylor, Lapeer, Mich., to the College. This change was rendered necessary by the demand of the students for instruction in beekeeping. Of the value of Mr. Taylor's work as Apiarist of the Station, I need not speak here. Every beekeeper in the Peninsular State has been benefited by the experiments performed by him and is acquainted with the nature and the quality of the work. Mr. J. M. Rankin of St. Clair, Mich., was placed in charge of the bees at the College.

In the field work of the Agricultural Department, emphasis has been laid upon two or three prominent features. The variety tests of wheat have been continued, confirming the results of the preceding year and demonstrating the value of both the Dawson's Golden Chaff and the Buda Pesth as additions to the list of wheat varieties that may be profitably grown in this State. The cultural experiments with corn were also

*The report on field crops has been carried to Nov. 1, 1897, so as to include the seasons' work.

continued. The department finds its work somewhat seriously handicapped by the lack of homogenity in the soil of the College farm. For this reason such experiments as depend for their value on the relative yields of small adjacent areas cannot be wisely tried.

The endeavor to find other forage crops adapted to the State at large and especially to the wants of the sandy plains of the northern part of the lower peninsula is an important feature of the farm experiments.

The interest taken by farmers in growing sugar beets called for experiments in growing this new crop. Through the generosity of the United States Department of Agriculture at Washington, D. C., the Station received early in March, 1897, a large amount of beet seed, which was distributed to such farmers in the State as applied, promising to give decent care to the growing roots and to report to the Station in the fall, sending samples of their beets for analysis. Time has not allowed supervision of these growing plots by someone connected with the Station. For this reason the results, which will be forthcoming after the date of this report, lack the element of certainty that would be theirs could more careful attention be given these widely-scattered plots. Both the methods and design of the experiments in 1897 are largely copied from those successfully adopted in 1891. The wide-spread interest taken in the matter leads us to hope that a goodly number of reports will be received from the seed sent out and the question of the adaptability of Michigan soil and climate to the production of beets rich in sugar may be settled, if the results of the experiments of this year corroborate the work of 1891. When it is remembered that it requires an investment of over $350,000 to build a factory for the manufacture of sugar from beets, the importance of being able to show by definite data the fact that suitable beets can be grown and that the farmers know how to grow them, can be readily appreciated. The first step in the introduction of this new industry is necessarily this comprehensive test of the soil and climate. Moreover, these experiments have a distinct value as educators of the farmer in the method of growing the roots.

The relation of the Experiment Station to the forestry problems of the State is yet to be established. The first step in the solution of these problems in a scientific manner is to find out somewhat accurately existing conditions. I believe that this may best be done by adopting the plan recently carried out in Wisconsin. An expert from Washington may be induced to survey the possible forest regions of Michigan and report his findings and suggestions to the State government and to the people through a bulletin of the Station. Plans for forestry management could then be based on substantial foundations. The legislature could determine wisely whether additional tracts should be purchased as an initial step in reforesting denuded areas, or whether some other plan had better be adopted.

The Station could then begin, or rather carry forward, investigations as to the best species of trees to be recommended for a given locality. It is fair to assume at the outset that the species growing in a given region are the ones well adapted to it. It does not follow because nature has placed certain varieties in certain situations that these same varieties are the ones which will best subserve man's requirements. Nature knows no limit of time in producing her results, while man desires the largest and quickest returns from his investment of labor and material. At best the length of time required in growing a crop of trees is more than a gener-

ation and the importance of a correct decision in the selection of the species to be planted cannot be exaggerated.

It is also a question of no little importance to determine the proper blending of species and the thickness of planting to secure the proper form of the tree and the production of the greatest quantity of merchantable lumber. The questions of light and shade have been thoroughly studied in Europe with reference to the species there grown. There remains a vast field of investigation in regard to the native or introduced trees of America. Under this head come, besides decisions as to varieties and thickness of planting, questions as to the size of openings in the forest, the wind mantle, and other matters relating to the possibility of correcting climatic conditions.

The State as a whole is more interested in securing proper treatment of the forests in the relatively thickly settled portions of the State than in reforesting present stump areas. There are to be found on many farms in the lower four tiers of counties areas that would better grow crops of trees than crops of cereals. In the future, not remote, many acres now under the plow will be replanted to trees. I conceive it to be a possible duty of the Experiment Station to suggest to the farmer, either as a result of experiments carried on at the College or upon such lands as the State may appropriate for the purpose, or as a result of the work done in foreign countries where forestry plantations have been successfully managed for generations, many points essential to the success of this venture of which the farmers are now necessarily grossly ignorant. Through the bulletins of the Station suggestions may be made to farmers as to the proper trees to grow and the right methods of raising them from the seed or setting them out in the waste places along streams or on the steep hillsides. The part which the State can play toward building up forest areas large enough to noticeably affect either the climate or the distribution of the rainfall is necessarily limited. The great bulk of the work must fall upon the private citizen who owns land suitable to the purpose. The farmers must therefore be educated first as to the necessity of forestry plantations, and second as to the shortest and best methods of securing them. At present most southern Michigan farmers seem to think that their duty to the farm ends with the cultivation of the plowed areas and that nature will take care of the wood lot and provide an abundant harvest of valuable timber, even if her domains are invaded by flocks of cattle and sheep. This and similar fallacies may be dispelled by proper instruction through the medium of the bulletins of the Experiment Station.

Along two lines the Station may be helpful to the State in this matter of forestry. First, by aiding a forestry commission which is empowered to prevent forest fires and the depredation of vandals and live stock on the areas devoted to the undertaking, by counsel in formulating plans and by co-operation of the botanist, entomologist, and other scientific men of the Station staff in carrying out these plans and warding off insect and fungoid diseases. Secondly, and this is by far the most important function, by awakening in the minds of the farmers in the southern part of the State an interest in the care of forests, a desire to extend forest areas and a willingness to set out new trees and care for existing forests by protecting them against fires and live stock.

I desire to call your attention to the fact that owing, as I believe, to the unsanitary condition of the old barn in which the College cows are

housed, our best cows have been condemned by the application of the tuberculin test. The departure of such cows as Belle Sarcastic, College Pogis, and Aida 2d from the College herd is noteworthy. The barns had been thoroughly disinfected and whitewashed after the removal of the cows condemned in November, 1896, but the disease reappears in other animals, which were condemned in the spring and summer of 1897. The unhealthy condition of the barn is due largely to the lack of suitable ventilation and the exclusion of direct sunlight from the floor. These defects cannot be easily remedied.

If it be not out of place, I suggest that the legislature be petitioned to grant the College an appropriation sufficient to cover the erection of a new dairy barn in connection with a large general barn to replace the numerous structures around which the College buildings are now growing. The present cow barn was built thirty-six years ago, and although in good repair, is inadequate to our wants and unsanitary. The horse barn is located between two brick buildings, and seems thrust upon the campus. It should be removed to a location farther away from the administration buildings.

In pursuance of the plan of moving the College barns near the center of the farm, a cheap dairy barn was built in the summer of 1897. A brief description of the structure will be given in Bulletin 149, now in press.

The ravages of tuberculosis in the thoroughbred herd made it seem wise to the committee in charge that a grade herd should be purchased, to be housed in the new dairy barn. These cows, while managed for economy of production, will afford farther data for the work long carried on in milk production and the care of milk and cream in butter and cheese making. The herd was tested with tuberculin, but none of the cows reacted.

The work in all departments of the Station has progressed harmoniously and satisfactorily. The bulletin list has rapidly increased and the influence of the Station on the agriculture of the State is more widely felt than before. Save the printing of the bulletins, the State is not asked for direct financial aid to the Experiment Station. There is a growing disposition in the Department of Agriculture to insist that the Station funds shall be as far as possible in the future expended for work done at the central Station or in experiments controlled directly by the Station employés located there, and not for the support of sub-stations. I suggest, therefore, that in view of the grand service rendered the State by the South Haven sub-station, the legislature be petitioned for a suitable appropriation to support that sub-station.

I herewith submit the annual reports of the several departments of the Station as a part of this annual report.

Respectfully submitted,

CLINTON D. SMITH,

Director.

AGRICULTURAL COLLEGE, MICH.,
November 1, 1897.

REPORT OF THE AGRICULTURIST.

I. THE COLLEGE HERD.

During the year covered by this Report, while a limited number of experiments were tried with other kinds of farm stock, the major part of this work was expended during the winter on the dairy herd. The records begun in 1894 were continued during the year, giving data as to the amount of food consumed by each dairy animal, the variations in weight, the amount of milk and fat yielded, and in general a full history of each animal in the herd.

In the spring of 1897, as a result of the application of the tuberculin test, several of the most distinguished cows in the herd were condemned by the veterinarian as tuberculous, and removed from the herd. Conspicuous in this list are the names of Belle Sarcastic, College Pogis, and Aida 2d. In October, College Rosa Bonheur and Cara were condemned.

The names of the cows composing the College dairy herd, the breed to which each belongs and the date of birth were given in a table on page 103 of the report of the Michigan Board of Agriculture for 1896. The dates of the close of the milking period completed within the year, the length of that period in days, and the amounts of milk and fat yielded, are given in the next table, together with their previous records.

Name.	Yields of milk and fat.				Average per cent of fat.
	Period.		Milk lbs.	Fat lbs.	
	Ending.	Length days.			
Belle Sarcastic	Nov., 1893	330	9,255.5	----------	----------
	Nov., 1895	570	30,514.2	915.94	3.00
	Aug., 1897	544	29,544.7	941.31	3.18
Houwtje D.	Aug., 1892	330	11,323.5	----------	----------
	Aug., 1893	300	10,780.0	----------	----------
	Nov., 1895	523	22,686.4	800.17	3.53
	Nov., 1896	365	16,758.0	570.81	3.41
	Nov., 1897	337	16,706.5	561.74	3.36
College Pogis	Aug., 1895	330	6,559.0	316.26	4.82
	Oct., 1896	330	11,314.7	553.06	4.88
	Nov., 1897	399	11,293.0	551.88	4.88
College Pogis 2d	Sept., 1895	330	4,793.5	227.05	4.73
	Sept., 1896	330	6,858.0	352.36	5.14
	Aug., 1897	294	6,306.4	330.96	5.24
College Houwtje	Dec., 1894	----------	7,482.3	239.45	3.20
	Jan., 1896	365	9,247.4	287.15	3.10
	July, 1897	431	12,638.5	371.99	2.94
College Pauline Wayne	Dec., 1895	365	8,186.4	265.49	3.24
	Jan., 1897	365	11,036.4	353.90	3.20
College Rosa Bonheur	Aug., 1897	357	14,326.4	460.53	3.21
Cara	Oct. 1896	450	5,918.6	234.85	3.97
	Sept., 1897	262	6,401.3	261.13	4.07
Oatka 3rd's Wayne	Sept., 1892	----------	7,574.5	----------	----------
	Aug., 1894	270	7,350.4	----------	----------
	Dec., 1895	450	11,909.8	379.42	3.20
	April, 1897	378	11,859.1	346.82	2.92

Much of the history of the feeding of these cows for the year and the lessons to be drawn from the experiments performed with them, has been written up in bulletin form to be issued as Bulletin 149. Since this publication will undoubtedly issue prior to this report, reference is made to it for the essential facts in the history of the herd.

A critical study of the feeding of the cows for the past two years has shown that for cows in full milk, although rapidly developing, the daily ration did not contain on the average more than 23.57 pounds of dry matter, 2.06 pounds of protein, and 12.5 pounds of carbohydrates per thousand pounds live weight where the average daily yield of fat was 1.21 pounds.

The repeated condemnation of cows in the regular dairy herd demonstrated the necessity of having better stables, better ventilated, and to which the sunlight could be more largely admitted. The large crops of clover hay and of corn made it seem wise to purchase a herd of grade cows to consume this extra forage. A new dairy barn was therefore built in August and September, and a grade dairy herd purchased in September and October.

Experimentally considered, it was designed to test the development of the cows. Grade Shorthorns were purchased as far as possible. They were bought under the conditions that surround the farmer when he desires to purchase such stock in the early fall. These cows are to be fed with a view to the most economical production of milk and butter, and farther to see how rapidly they can be developed and their milk-giving abilities increased.

A description of the barn will be given in Bulletin 149, already in the hands of the printer.

Owing to the use of the barn, heretofore occupied by pens of feeding lambs, for the tuberculous cattle, it was impossible to try experiments in feeding sheep during the winter of '96-97. For the same reason experiments with fattening pigs were omitted for that year.

The poultry, of which the Station owns representatives of many of the leading breeds was managed during the year for the purpose of giving instruction to students and in continuation of the experiments of the preceding year in regard to fattening young chickens, feeding laying hens and the management of incubators.

II. FIELD EXPERIMENTS.

The plot experiments during the season of 1897 were in charge of Prof. Crozier, except when he was necessarily absent from the College by reason of ill health. Below is given an outline of the field experiments, the full details of which are either on file for future bulletins or already published.

Wheat—Twenty-five acres of wheat were sown in the fall of 1896. Nearly one-half was Buda Pesth, the remaining varieties grown under field conditions were Red Lorraine, Red Altkirche, Sterling,* Pride of Genesee, Russian, Dawson's Golden Chaff, Selected White Clauson, Diehl-Mediterranean and Currill. In small plots or drills there were also sown samples of Long Amber, Early Arcadian, Missoyen, Volo, Plymouth Rock, Krimsh, Gray Winter, Red Bearded, Barnatka, Perfection,

*Purchased under this name as a new variety but evidently Egyptian.

Nigger, Sandomir, Genesee Giant, Reliable Minnesota, also seven varieties from Japan and five cross bred wheats from Australia, the latter were the most promising of the ten cross bred wheats from the same source grown at the College the preceding year. We have to report that all of the Japanese wheat winter-killed as did also the Missoyen and Volo. The cross bred wheats were badly injured by the same cause and, as in the preceding year, ripened late and produced only shrunken grains.

The varieties grown in the field were sown between September 18 and 22, on an oat stubble without fertilizer of any kind. The yield per acre was as follows:

	Bushels.
White Clauson	24.7
Dawson's Golden Chaff	23.0
Sterling (Egyptian)	22.8
Buda Pesth	22.0
Diehl-Mediterranean	21.7
Russian	20.0
Pride of Genesee	17.5
Currill	17.0
Red Altkirche	17.0
Red Lorraine	14.3

The Currill was not grown in the same field with the other wheats which were sown side by side in Field 8 in plots ninety-two rods long and wide enough to contain at least an acre. The soil was reasonably uniform only and the results given above are fairly comparable. Observations on many of these varieties were published in Bulletin 141, issued in February, 1897. The White Clauson still maintains itself as one of the best varieties for conditions similar to those existing on the College farm. Dawson's Golden Chaff stands well along side it in yield. It was free from smut, a fact due undoubtedly to the treatment which the seed received before sowing. The Buda Pesth is objected to by many farmers because of its awns. It is productive and is reported to be of good milling variety. The Russian has a very fine straw and a small head, is much earlier than the other varieties and seems well adapted to the northern counties of the southern peninsula. The Red Altkirche and Red Lorraine are not yet acclimated and their qualities must remain for future experiments.

Millet—Two new varieties of Panicum miliaceum are offered to the public for the first time this year, by a western seed firm. One of these, the Siberian millet, was reported upon by us last year; the other, called Early Fortune, is a medium early, medium growing, red seeded variety obtained also from Siberia. By the same firm two lots of seed from Armenia have been grown, the variety seeming a little more vigorous, but otherwise similar to the yellow seeded variety of this country. The selection of Hungarian grass has been continued on the line adopted four years ago and a stock is now secured, which, when properly matured, is practically free from light colored seed.

Corn—The results of the experiments performed with corn confirm the work of the preceding year reported on page 108, of the Report of the Michigan Board of Agriculture for 1896, in a general way though modifying in some important details the conclusions there reached. The plot sowed with a grain drill, two bushels of seed per acre, did not in

1897 return either the greatest amount of green fodder or dry matter. That honor belonged the plot in which the rows were forty-two inches apart. The yield of protein increased as the distance between the corn plants was lengthened up to forty-two inches apart between the rows with kernels three inches apart in the rows. Such rows also yielded the greatest amount of N. free extract per acre. An important point was brought out in the selection of the seed corn, namely, that a well matured crop furnishes so much better seed than one ripened in unfavorable weather that it abundantly pays to save seed corn for two or three years in order to plant thoroughly ripened kernels. There was a difference of 11 per cent in favor of the crop grown from two year old seed well ripened over the one planted with seed of the previous year which was cold and rainy at and before harvest. By the kindness of the Chemical division of the Station analyses have been made of the leaves, stalks and ears of various kinds of corn in successive stages of ripeness. The results are being prepared for publication. The results of the other experiments in the field culture of corn will be ready for publication in the same bulletin. The continuation of the studies on the life history and remedies of corn smut have reached no definite conclusion. So far no means of lessening the disease have been discovered. It is fortunate that when the corn plants are attacked by smut the resulting products are not poisonous to live stock. The great vitality of the spores and their persistence in the soil through the lapse of several years, makes the treatment of the disease a difficult matter. Several varieties of corn were tested. The seed of the Gilman Flint has been reserved to send to the northern part of the State next spring. The variety promises well because of its earliness and abundant forage for that section of the State. An experiment conducted by Mr. Fulton brought out the fact that there was a material difference in the water content of cornfields when properly cultivated and when neglected.

Oats—Several varieties, including the International, Scotch Chief, two strains of the American Banner, Lincoln, Michigan Wonder, Early Siberian, and New Marine were tested. The season was so illy adapted to the growth of this crop that the results of the test will not be reported until confirmed or disproved by the work of another season.

Clover—The season of 1897 has been moist and well suited to the production of a large yield of this legume. Alsike, which has been heretofore a rather treacherous crop, has demonstrated its value in wet seasons and proper soils. In Field 12 it has given abundant pasture and a yield of hay amounting to a ton per acre. Both the Mammoth and the June Clover have returned heavy crops amounting to fully two tons to the acre at the first cutting. Neither of the last two varieties of clover have done as well on muck on the College farm as the Alsike.

Other forage crops—Owing to the cold and somewhat backward spring the cow peas purchased of a southern firm did not make a good stand. The Alfalfa, which gave nearly five tons of hay per acre the previous year, was totally killed by the winter, and hardly a living root could be found in the spring of 1897. Neither Kaffir corn nor sorghum showed superiority to Indian corn when allowed to head out and approach maturity before cutting. A new forage crop for sandy lands called Sand Lucerne gives great promise, though its ability to withstand the winter has not

yet been demonstrated. The Bromus inermis seed received from the Department of Agriculture at Washington, also promises well.

Forestry—In the fall of 1896 there was sent to W. J. Beal, Professor of Botany and Forestry in the College, a collection of tree seeds from the Forestry Division of the Department of Agriculture. These seeds had been collected in various portions of the United States, there being many samples of each species, collected from as many sections of the country. The object of the collection and planting was to determine what distinctions if any could be seen in the trees as they developed, between those of the same species the seeds of which came from different localities. These seeds were planted in the spring of 1897 in the forestry plantation near the river east of the woods east of Field No. 7. They were put in between the rows of pines already started. Following is the order of planting, the rows running east and west and counting from the north, the enumeration of the trees in each row beginning at the east.

1. Juglans nigra, Missouri; Juglans nigra, Colorado; Juglans nigra, Ohio; Juglans nigra, Kentucky.

2. Quercus macrocarpa, Vermont; Juglans nigra, Col.; label lost; Juglans nigra, Mo.

3, 4, 5, 6. Bitternuts planted last year.

7. Celtis occidentalis, Ohio; Fraxinus lanceolata, Col.; Acer negundo, Col.; Fraxinus Americanus, Conn.

8. Pines set out last year, first row.

9. Celtis occidentalis, Ohio; the same from Ohio; the same from Oklahoma; the same from Kansas.

10. Acer negundo, Ohio; Acer negundo, Neb.; Acer negundo, Ohio; Acer negundo, Ohio.

11. Pines, second row.

12. Gleditschia tricanthos, Kansas; the same from Pennsylvania; the same from Kentucky; the same from Ohio.

13. Fraxinus lanceolata, Texas; the same from Kansas; the same from Nebraska; the same from Illinois.

14. Pines, third row.

15. Celtis occidentalis, South Carolina; the same from Texas; Gleditschia tricanthos, Kentucky; Gymnocladus dioecicus, Kentucky.

16. Acer negundo, Kansas; the same from Texas; the same from Oklahoma; the same from Illinois.

17. Pines, fourth row.

18. Pines, fifth row.

19. Pines, sixth row.

20. Fraxinus lanceolatus, Oklahoma; the same from South Dakota; the same from Colorado; the same from Kentucky.

21. Acer negundo, Iowa; Acer negundo, South Dakota; Fraxinus quadrangulata, Kentucky; Acer negundo, Colorado.

The forestry work begun two years ago has been continued through the season, the rows kept in repair, the windbreaks cultivated, vacancies supplied with new trees, dead trees cut out and the forestry managed according to the methods adopted at the beginning.

FARM CROPS.

It is unfortunately true that many farmers content themselves with a very meager knowledge of their own business transactions and the results of their farming operations for the year and keep no books of account whatever. Others are satisfied with the meager information given by successive annual inventories, still others besides keeping in a book their financial transactions and memoranda of bargains and executory contracts made, record for each field the amount of produce grown upon it and something as to the cost. We have found it impossible to keep anything like an accurate account of the cost of production without keeping for each employe a separate monthly time sheet showing the number of hours each day expended in the different fields or for some other branch of the farm business. It is an exceedingly simple and easy thing to do to set down, at the close of each day's work, figures under the given date indicating the number of hours spent in the different occupations. At the close of the month the amount of time spent upon the field is easily determined by adding together the number of hours spent by the individual men and teams.

To do complete justice between the different accounts with the different phases of the farm work, the live stock should be charged with the food consumed and the straw used for bedding. It has been our practice to eliminate the latter details. Each crop is charged with the time spent in hauling the manure to the fields and spreading it, the live stock is not charged with the bedding nor credited with the manure.

The following table reports the crops harvested on the several fields of the College farm in the year 1897 and the cost of the labor involved in their production:

Field.	Area acres.	Crop.	Cost of labor.	Yield pounds.	Remarks.
3	....	....	....	....	Experimental plots.
4	....	....	....	....	Small pasture lots.
5	1	Beans	$7 87	1,959	Test of varieties.
6	5	Corn	36 84	548 bu.	Golden Dent.
6	5	Roots	147 00	118,274	Four acres sugar beets, one mangolds.
6	2	Barley	....	1,075	Success.
6	3	Oats	....	5,103	Variety tests.
6	1	Corn	....	3,135	Gilman Flint.
6	1-10	Spelt	....	145	For stock food.
7	17.07	Hay	17 50	22,000	An old meadow.
8	23.66	Corn	423 13	106,981	Silage.
8	....	....	....	26,974	Corn stalks.
8	....	....	....	860 bu.	Corn
9	23.78	Hay	61 75	107,677	Mammoth and June clover.
10	23.55	Wheat	191 91	501 bu.	Variety tests.
11	23 95	Hay	46 55	93,390	Medium clover.
12	34.50	Hay	32 50	71,940	Alsike. Pasture worth $54.45.
13	3	Potatoes	....	....	Total failure.
13	27	Hay	75 40		Yield not yet weighed.
14	9	Corn	....	574 bu.	Hathaway Dent.
14	....	....	....	19,835	Fodder.
14	12	....	124 12	....	Experiments.
15	18.15	Hay	26 75	80,585	Timothy.
16	32	Oats	362 00	1,600 bu.	Field being cleared.

In Nos. 6 and 14 the cost of the labor of the crops could not be given because experiments were conducted, so many weighings were necessary and so much time was devoted to objects other than crop production that to state the amount of time expended on the field for the sake of comparison with the crop produced would lead to erroneous conclusions.

The lessons to be drawn from many of these crops are compiled in a bulletin to be issued this November and numbered 149.

CLINTON D. SMITH,
Agriculturist.

AGRICULTURAL COLLEGE, MICH.,
November 1, 1897.

REPORT OF THE HORTICULTURIST.

To the Director:

SIR—I herewith present the report of the Horticultural Department of the Experiment Station, for the past year.

There have been few changes in the department, either in the lines of work pursued, or in the assistants who have taken part in it. During the year four bulletins have been issued, No. 142, Small Fruit Trials at the College; 143, Fruit Tests at South Haven; 144, Vegetables, Old and New, and 148, Strawberries. We have now, nearly ready for the printer, several other bulletins that will be issued during the next two or three months. Last spring a number of experiments in cultural method were undertaken, and good results secured up to the first of August, but the heavy rains at that time, continuing for several days, so affected the plots that no definite results could be secured, and the bulletins published have related almost entirely to the tests of varieties.

STATION ORCHARDS.

The young orchard, planted at various times during the past ten years, is now coming into bearing, and, if the conditions are favorable next year, we shall be able to make a thorough test of many of the new kinds of tree fruits. This year, owing to the almost total failure of the apples, only a few varieties have fruited, but a large number of cherries bore this season, as did many of the plums and pears, and among the new varieties there seems to be several that that are worthy of general planting. Among the cherries that seem particularly promising are Brusseler Braune, Wragg and Vilne Sweet. The former has fruited, more or less, for the past four or five years, and has several times been favorably noted in bulletins; it is a variety of the Morello type, and, for that class, is particularly strong growing and upright in habit. It is an early bearer, and in productiveness is equaled by few sorts; the cherries are fully as large as many of the sweet varieties and are of a very dark brownish-red with dark flesh; the flavor is acid and, when ripe, they

lack, almost entirely, the bitter taste often found in Russian sorts. The stems are oftentimes three inches long and are attached so firmly that the fruits remain for a long time, upon the trees after they are ripe. In season, it is one of the latest sorts, coming even after the English Morello.

Wragg has been found unusually productive this season, the branches resembling ropes of fruit, so thickly were they clustered about them. The trees, while young, made but slow growth and on this account did not appear very promising. This trouble, perhaps, may have been due to the stock upon which they were grown. Our oldest trees have taken on a good form with a rounded head and rather stout branches, for the Morello class. The fruit is not quite as large as Brusseler Braune and the fruit stalks are shorter, but in size, color and flavor, it resembles it very closely. This variety seems to be, both in tree and fruit, an improved form of the English Morello.

Vilne Sweet is, in growth, between the Heart and Duke classes and seems to have the hardiness of the Duke with the size and flavor peculiar to the Hearts. The tree is of upright habit with stout branches, and seems to be hardier, both in tree and buds, than the ordinary sweet varieties.

Several of the Japan plums are now in fruit and many of the varieties seem to be very promising as market sorts, as well as for home use. Among the most promising are Abundance, Burbank and Red June, while in sections where the peach will thrive, Satsuma and Wickson have much promise. The latter, especially, is likely to be valuable on account of its large size, good quality, and its habit of bearing early and abundantly. Most of the other varieties seem to be hardy in tree, but we have not yet fruited the new sorts like Hale, Juicy, Gold and Normand. The specimens of Gold received from the introducers, Stark Brothers, of Louisiana, Missouri, resemble in their shape, fruit stalk, etc., the native plums, but are of a much larger size.

A large number of varieties were received last spring from the Division of Pomology of the National Department of Agriculture, and were planted in the orchard. Arrangements have also been made for testing the comparative hardiness of the different races of peaches in accordance with the scheme proposed by Prof. R. H. Price, of Texas, at the last convention of Agricultural Colleges and Experiment Stations.

SMALL FRUITS.

The strawberries planted in 1896 were in a very promising condition during the early part of the season, but, owing to the extreme heat during the fruiting period, we were not able to secure as definite notes regarding the exact date of the ripening of the different varieties as we had hoped, as many kinds that are ordinarily classed as medium, or late sorts, ripened with the early kinds. Among the more promising of the new kinds might be mentioned Ruby, Glen Mary and Ideal.

The same trouble was found in the raspberries, as Loudon, which in 1896 ripened sixteen days later than Cuthbert, was ripe at the same time this year. Ordinarily Loudon will probably be a valuable kind, as the plants are hardy, very productive and the fruit is large, firm and of a good quality. The only objection seems to be that the plants

are rather weak in growth. As noted in the bulletins last year, many of the varieties that have been introduced as novelties, such as Wineberry, Loganberry, Mayberry and Strawberry-raspberry, have little, or no, value and excepting the Strawberry-raspberry, are lacking in hardiness, and that variety instead of being a hybrid between the strawberry and raspberry, is a wild Japanese species of raspberry; the plants sucker freely and are likely to become a pest, while the fruit, although large and showy, developes on a very large receptacle, and, as a result, has a cavity nearly as large as that in an ordinary thimble, while the flesh of the fruit is but little thicker than the walls of that useful article. The flesh is dry, with large seeds and acid flavor.

During the heavy rains of August, although the land was underdrained, the water stood so long upon a portion of the raspberry plantation that many of the plants were killed.

The blackberries, although unprotected, came through the winter without injury and bore a full crop, which, owing to the moist season ripened without injury from drought. The results obtained with the different varieties of small fruits will be published in the bulletins.

VEGETABLE GARDEN.

As in the previous years, all of the most promising novelties brought out by the seedsmen, were planted for trial, as were many of the standard kinds, for comparison. During the season we were considerably troubled by numerous insects, but most of them were kept in check by the prompt use of insecticides. Several fungous and bacterial diseases that had not appeared to any extent developed during the warm, moist weather of the past summer and may prove troublesome in the future. Among these was a bacterial disease which attacked the cauliflower and some of the cabbages. For this the best thing is to destroy the diseased plants and thoroughly clean up any refuse that may remain upon the ground, and to use new land the following year. In sections where the disease has not appeared it would be desirable to soak the seeds, for half an hour, in a weak solution of copper sulphate, or liver of sulphur at the rate of one ounce to three gallons of water. Arrangements were made to make a comparative test of the different varieties of celery but the plants were destroyed by standing water.

SPRAYING.

As noted above, the season was favorable to the development of insects, particularly plant lice and potato beetles, and fungi, and the frequent rains throughout the season made it difficult to use applications for their destruction. Plums, cherries and other fruits were seriously injured by the aphides and a number of remedies were tested for their destruction, including tobacco water, kerosene emulsion, zenoleum, whale oil soap, etc. The best results were obtained from the strong tobacco water. In spraying for the various leaf-eating insects, the arsenites were used and the principal reliance was placed upon Paris green and white arsenic. Although it varies in different years and different places, white arsenic can generally be secured for little more than one-half as much per pound as Paris green, and, as the latter only contains a little more than 50 per cent arsenic, the actual cost of arsenic as a

spraying material would be about one-third as much as the Paris green. We have tested it thoroughly against insects upon fruit trees and various kinds of vegetables, including potato beetles, and, when properly prepared, have secured as good results as from Paris green, without injuring the foliage.

By boiling one pound of arsenic with two pounds of lime in two gallons of water for forty minutes, the arsenic becomes insoluble and does not injure the tender foliage. When the above is added to 400 gallons of water, for fruit trees and 200 gallons for potatoes, the result is even more sure than from Paris green. The lime should be carefully slaked with water, and, although the amount used in the preparation of the arsenic will suffice to prevent injury to the foliage, it is desirable to add ten pounds for each 400 gallons of water, when ready for use; this will tend to hold the arsenic upon the foliage.

During the past season curl-leaf was very troublesome to the peach leaves, causing in many cases most of them to fall from the trees and the loss of the entire crop of fruit. A circular was sent out in the spring advising the use of Bordeuax mixture as a preventive for this disease and several persons who tested it, reported excellent results from it use. In order to be effectual, the spraying should be done before the growth starts, and again as soon as the flowers have fallen. It is advisable to use double the amount of lime, and special pains should taken to thoroughly coat the trees with the fungicide, as otherwise the treatment will be only partially successful.

THE SAN JOSÉ SCALE.

During the winter of 1896-97, specimens of the San José scale were received from several sections of the State, and, as the owners of the orchards, reported that they received their stock from New Jersey firms, endeavors were made to secure the addresses of all Michigan parties to whom trees had been sent since 1889; the nurserymen kindly furnished a list of their customers, and a circular was prepared and mailed to each of the four hundred and twelve persons whose names were thus secured, as well as to all on the regular mailing list of the Station. In this circular a brief history of the spread of the insect in this country and a description of its appearance, was given, and all persons receiving the circular were urged to carefully examine the trees they had received from nurseries in the last eight years, and, if they found traces of any insect likely to be the San José scale, they were requested to send samples to the Experiment Station for identification and methods of treatment. As a result of this circular, several hundred specimens of all kinds were received, but happily not more than a half-dozen of the dreaded San José scale. Many of the specimens were the oyster-shell scale, rose scale, Putnam scale, and aphis and other eggs, while a large number were nothing more than cork cells on the bark, spots of paint, and wounds due to various causes. In several places where the San José scale was found, they had not spread from the original trees, and were at once destroyed, but in others they had spread until considerable areas were infested. The worst infections were in Ottawa and St. Joseph counties. In one place in Ottawa county, the insects had spread from young plum trees to large cherry, pear and apple trees and were scattered over several acres, including a number of apple

trees twenty-five or thirty years old. This orchard was visited and the owner, under instructions, cut back the trees and gave them a thorough spraying with whale-oil soap, at the rate of one pound to a gallon of water, and kerosene emulsion containing one gallon of kerosene to three gallons of water. The work was quite thoroughly done, but even then a few scales escaped and further treatment will be necessary. Early in October, the presence of the scale was reported in another orchard, two or three miles from the one above mentioned, and it was found that it had spread over 1,200 young apple, peach and pear trees, from five to eight years old, and it had also secured lodgment in an adjoining forest of 200 acres. As this colony was not located until after the orchard and nursery inspection laws went into effect, the matter was placed into the hands of the State inspector. Where the trees were not destroyed, all parties reporting the scale were urged to cut back and spray their trees; in most cases this advice was followed.

BLACK PEACH APHIS.

The black peach aphis has spread through a large number of orchards in the vicinity of Grand Rapids and thousands of trees have been destroyed; it was brought in on nursery stock and has spread from the young trees to the bearing orchards. After treating with various insecticides, including bi-sulphide of carbon, kainit, tobacco, salt and wood ashes, it was thought best to recommend the use of the latter, as it not only semed as effective as the others, but it is worth more than its cost as a fertilizer for most of the orchards and can be applied without danger to the trees. Tobacco water was considered the second best remedy. In order to prevent any possible injury to the trees by this insect, we have recommended soaking the trees in tobacco water before they are planted. Where this advice has been followed, no case of infection has been reported.

GUM DISEASE.

Reports have been received from various parts of the State, of injury to peach trees by the development on the branches of knots, from which gum exuded; examination failed to show the presence of any specific disease and the swellings are thought to be the result of injury to, or rupture of the bark. In some cases the bark has been weakened by the attack of various fungi, while in others, it has the appearance of having been ruptured by the action of frost upon tissues that have failed to ripen in the fall, or that have started into growth in the spring. As a result of these injuries the sap exudes and a corky, knot-like growth forms and, if the injuries are severe, it generally results in the weakening of the branches, and, since there will be danger of their breaking down, it will be desirable, if the injuries are severe, to cut back the branches below the injured portions.

CROWN GALL.

Many complaints have been received regarding the sale of nursery stock bearing galls upon their roots; these are found upon nearly all kinds of fruit trees, but particularly upon the peach. The exact nature of the disease is not known, but it is thought to be contagious, especially

upon soils rich in organic matter; and thus the use of stable manure in large quantities upon land to be used either for a nursery or an orchard, should be avoided, particularly if the soil is inclined to be moist, is it provides the conditions that seem to be favorable to the development of the disease. When the trees have galls upon the collar, or upon the larger roots they should not be planted as they will never make a desirable growth.

The wooly aphis is also reported in many young orchards and in some nurseries. This is troublesome further south where it does considerable injury to the trees and infested nursery stock should be very rigidly and effectively treated; the same remedies may be used for these as for the black peach aphis.

EXPERIMENTS IN IRRIGATION.

During the past season the rainfall was ample for the growing of all our crops, except for a short time during the early part of July and during the fall and so we were not able to secure any definite results from the experiments we had planned. A single irrigation of the strawberries resulted in a marked benefit, while the use of water upon the late cabbage and cauliflower in September, helped us to secure a good crop, while without the use of water it would have been an entire failure.

THE SOUTH HAVEN SUB-STATION.

The charge of the work at the South Haven Sub-station has remained in the hands of Mr. Lyon, whose report will soon be issued as Bulletin 152.

With the exception of the peach crop, which was greatly reduced by the loss of the fruit buds in the winter, the crops have been good. All the older trees are in bearing and many of the young pears and apples, planted since the establishment of the Station, bore a few fruits last year. The land is now nearly all occupied with trees, with the exception of a small area especially reserved for small fruits; this will make it impossible to extend the planting as we would like but by top-working the trees that have been tested we can provide for the addition of promising new varieties.

As the strawberries can be tested quite thoroughly at the College, and as the land that is now occupied by them will be required for other small fruits, it is thought best to make no other plantings of strawberries at the Sub-station.

During the year trellises have been provided for the grapes in the southwest block and a number of rods of tile have been laid in the northeast block, which completes the tiling of the Station tract.

CO-OPERATIVE VARIETY TESTS.

As has been explained in previous reports, it has been the policy of the department to utilize any surplus trees or plants of new varieties for distribution. This plan has been continued the past year and we now have the co-operation of a large number of experimenters, in most of the counties of the State, in this work. While the results have not,

in all cases, been satisfactory, yet as a rule we have been well pleased with the interest that has been taken and with the reports that we have received.

ASSISTANTS.

During the year I have aided by H. P. Gladden and M. L. Dean, who for several years have acted as assistants in this department. They have had charge of the details of most of the experiments; the note taking has been performed by them, or under their directions, and the results have been compiled by them for the bulletins.

Respectfully submitted,

L. R. TAFT,

Horticulturist.

AGRICULTURAL COLLEGE, MICH., *November 30, 1897.*

REPORT OF THE CONSULTING BOTANIST.

To the Director:

I respectfully submit a report of the work done by the consulting botanist for the experiment station during the past year.

The character of the work has not changed from that of former years except in the increased amount of time required to keep pace with the increasing work, which consists in answering numerous questions about plants, the examination of seeds of grasses and clovers, studies of smuts of grains and other parasitic plant diseases, and work in the herbarium.

SEED EXAMINATION.

As it becomes more generally known that the station botanist is willing to examine seeds for any person who may request such examination, more farmers send samples of clover seed and grass seed to be tested each year.

The necessity for careful examination of seeds of farm crops becomes more and more apparent each year, especially if such seeds are imported from the old world.

The following lists of old world weeds found in two fields on the college farm during this year will tend to confirm the above statement:

Weeds in crimson clover. Seed imported from Europe:

Lepidium Campestre—Mithridate Mustard.
Lychnis vespertina—White Campion.
Brassica alba—White mustard.
B. sinapistrum—Charlock.
Anthyllis vulneraria—Kidney vetch.
Anthemis arvensis—Corn Chamomile.
Bromus secalinus—Chess.
Agropyrum repens—Quack-grass.
Erodium cicutarium—Common Storksbill.
Brassica campestris—Summer Rape.

Weeds in orchard grass seed imported from France:

Brassica monensis—a mustard.
Arabis perfoliata—Tower Mustard.
Iberis amara—Wild Candy-tuft.
Camelina sativa—False-Flax.
Silene Cucubalus—Bladder-Campion.
Lychnis Vespertina—White Campion.
Geranium—Geranium.
Melilotus officinale—Yellow Melilot.
Medicago lupulina—Black Medick.
Potentilla Norvegica—Norway Cinquefoil.
Cnicus arvense—Canada Thistle.
Arctium Lappa—Burdock.
Leucanthemum vulgare—Ox-eye Daisy.
L. Maxium.
Tragopogon pratensis—Goat's-beard.
Picris hieracioides.
Crepis biennis—Rough Hawk's-beard.
Galium Mollugo—Great Bed-straw.
Carum Carui—Caraway.
Plantago lanceolata—Ribgrass.
Rumex acetosa—Sorrel Dock.
R. acetosella—Common Sorrel.
R. crispa—Curled Dock.
Holcus lanatus—Velvet Grass.

PLANT DISEASES.

Several diseases of farm crops which have not been observed on the college farm before, seem worthy of notice.

A TURNIP DISEASE.

(*Alternaria Brassicæ.*)

In August a serious fungous disease appeared in the turnip fields at the college. The leaves were covered with dark-colored spots which were the seat of the disease, these continued to increase until the leaves were destroyed. Finally the roots were attacked with a bacterial disease causing a wet-rot which completed the destruction of the crop.

A MILLET DISEASE.

(*Sclerospora graminicola.*)

This disease was first noticed in August by Prof. A. A. Crozier, who submitted some diseased plants of German millet to me for identification. Later the disease was found on Green Fox-tail-grass.

A LETTUCE DISEASE.

(*Marsonia perforans.*)

Late in March, 1897, Mr. C. M. Norton, an extensive lettuce grower of Grand Rapids, sent the consulting botanist some lettuce plants which were troubled with a new spot disease. An examination of the literature on lettuce diseases showed that the fungus which produced this disease had been described in 1896 by Ellis & Everhart.

This disease is much increased by surface watering and may be controlled by sub-irrigation. The disease is confined to green-houses and was first noticed by Prof. A. D. Selby of the Ohio experiment station.

A CLOVER DISEASE.

(*Glœosporium sp.*)

The last week in May the red clover plots showed the existence of a fungous disease which attacked the leaves and finally the stems of

clover plants; in many cases the leaves were entirely destroyed, giving the border of the field a decidedly brown appearance. Fully one-half of the plants were more or less affected.

The corn smut experiments have been continued along the lines mentioned in the last report. Work in the herbarium has been increased somewhat by large collections of edible and poisonous fungi of the region about the college.

Farmer's Institutes were attended during the fall at Marquette, Iron River, Norway, and Stephenson. The round-up Institute at St. Louis was also attended in March.

C. F. WHEELER,
Consulting Botanist.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1897.

REPORT OF THE CONSULTING ZOÖLOGIST.

Professor Clinton D. Smith, Director of Experiment Station:

SIR—I have the honor to submit the following report for the year ending November 30, 1897:

In December, 1896, when I assumed the direction of this office, the Station was without an assistant entomologist owing to the recent resignation of Gager C. Davis, M. S., who had removed to California on account of his wife's health. Steps were taken at once to secure a competent assistant for the position thus vacated, and the Station may be considered fortunate in obtaining the services of Rufus H. Pettit, B. S. A. (Cornell), who was then serving as Assistant State Entomologist of Minnesota, and who reported for work here early in January. He has proved himself a most competent and conscientious entomologist, and a very large share of the work of the season has been left in his hands, as was contemplated when I consented to take charge of the office, my own time being fully occupied with the class work pertaining to my departments in the College. Nevertheless, the work of the year proved to be more arduous than was expected by anyone, and in spite of the fact that only one-half of Mr. Pettit's time and none of my own could be claimed by the Station, in reality both of us have given much more than was due, being compelled in some cases to neglect class work in order to accomplish for the Station what seemed imperative.

The discovery early in the year 1897 that the San José Scale was firmly settled in at least one county of the State led to further investigation, which proved eventually that this pest had been introduced in at least a dozen localities in the southern half of the State, and in most cases had become firmly established and was in danger of spreading widely.*

One of the first results of the San José Scale agitation in Michigan was a flood of inquiries as to the character and appearance of the pest, to-

*For a list of these localities and other data relating to the subject, see a paper read by the writer before the Society of Economic Entomologists, at Detroit, August, 1897, and published in the Proceedings of that society.

gether with multitudes of specimens of insects of all kinds (and some not insects at all), suspected of being the dreaded scale, and sent for positive identification.

Several trips were made to infested points; steps were taken to locate centres of infestation; and considerable time was spent in discussing with members of the Legislature, committees of the State Horticultural Society, and representatives of the prominent nurseries of the State, the provisions of a bill drafted for the restriction and extermination of this and similar pests. As you are well aware, such a measure was passed by the Legislature in the spring of 1897, and in accordance with its provisions, Professor U. P. Hedrick, lately of the Oregon Agricultural College, was appointed State Inspector of Orchards and Nurseries, in September. His efforts thus far have been directed mainly toward the inspection of all nursery stock in the State and the prevention of importation of infested stock from outside. If he can at once have sufficient expert help in locating infested spots outside the nurseries much can be done before spring toward stamping out the pest, but if this is delayed until another winter the task will be very seriously increased and ultimate success correspondingly doubtful.

It is hoped that the appointment of so competent an inspector will relieve this office of most of the work relating to this scale, since our allotment of $500 is barely sufficient for the routine work of the office, while the additional burden imposed during emergencies like the present not only weighs heavily on the members of the division but unavoidably detracts from the class work of the College. Full and prompt attention to the correspondence during the past year would of itself have required all the time for which the Experiment Station pays, and any Station work done outside of this must be looked upon as a generosity on the part of the College or a voluntary sacrifice on the part of those who do the work. Of course many insects are sent in for identification which can be named at sight, and many simple questions are asked which require no investigation before replies are sent. Many such inquiries can be answered by a few written words and a printed circular or card giving formulæ for insecticides and directions for treatment. On the other hand many of the letters received necessitate the comparison of many specimens, the examination of a large amount of literature, and the expenditure of much time and care in giving the correspondent the results of such work. More than 200 such cases have been disposed of during the year, while several hundred more letters have been written in reply to simpler questions which involved little or no investigation.

For several years past, at least, the consulting entomologist of the Experiment Station, although receiving half his pay from the College and half from the Station, has divided his time very unequally, giving from three-fourths to five-sixths of the entire time to the work of the Station and allowing the College work to suffer. The injustice of this is apparent at once, and such an arrangement cannot be continued in the future. If the Michigan Experiment Station is to maintain the high standard of entomological work which it has set in the past it will be necessary that the entomologist be able to give all or nearly all his time to the work of the Station, while additional assistance is provided for the College department of anatomy and zoology. Perhaps at no time in the history of the State have its agricultural interests been so strongly menaced

by insect invasion as now, and it is of the utmost importance that the Station should have at its disposition at all times the services of an expert entomologist who can give his entire time if necessary to the solution of the important problems which are ever presenting themselves.

Besides the San José Scale several formidable insect pests have attracted attention during the year, at least two—the Pear Psylla and the Black Peach Aphis—appearing in injurious numbers for the first time in the history of the State, while one, the Asparagus Beetle, *Crioceris asparagi*, seems to have been introduced within the year and to threaten serious damage to asparagus growers in the southwestern part of the State unless energetic measures for its repression are taken at once. The Wooly Aphis, *Schizoneura lanigera*, also proves to be alarmingly common in young apple orchards and nurseries in some sections of the State and is likely to prove an insidious and dangerous foe. Specimens of all these insects, as well as of scores of others have been received for identification and the senders have been fully informed on the questions raised.

Other insects which have demanded more or less attention are the various species of plant-lice, scale-insects, cut-worms, and grass-hoppers, the white-pine saw-fly, the true army-worm (*Leucania unipuncta*), the erratic army-worm (*Noctua fennica*), the bud-moth (*Tmetocera ocellana*), the apple leaf-tyer (*Teras minuta*), and such common and well-known pests as the tent-caterpillar, canker-worm, pear slug, and many others. The more important of these will be treated in a bulletin on the insects of the year, now in preparation.

Aside from entomological subjects, the zoologist has been called on during the year for information in regard to many species of birds, both beneficial and supposedly harmful, and has been able to collect some interesting facts as to the food-habits of some of our most common birds, together with notes of interest on the distribution and life histories of a few of the little known species of the State.

Queries have been received also and information furnished relating to damage by field-mice, moles, rabbits, woodchucks, squirrels, skunks, and minks, and the best methods of combating these animals when desirable.

We have also identified for the Veterinary Department a few species of internal parasites, thread-worms, tape-worms, etc., and have received a few additional specimens of such parasites from other parts of the State. I might add that we desire to increase the College collection of parasitic worms, and would be glad to receive specimens from any source.

Respectfully,

WALTER B. BARROWS,

Consulting Zoölogist.

AGRICULTURAL COLLEGE, MICH.,
Dec. 30, 1897.

REPORT OF THE BACTERIOLOGIST, VETERINARY DEPARTMENT.

To the Director:

The following is a synopsis of the experimental work on tuberculosis:

The study of tuberculosis is one primary theme in laboratory work, and for the past year our purpose has been to examine carefully the milk, urine, feces, and sputum from the tuberculous cattle at our disposal. This line of investigation has been prosecuted so far as is within our facilities. At the outset, we appreciate that we have begun no new field of research, but one over which the plow has left little to upturn. Our object is not so much to reveal new things, as it is to render available and practicable what is already known in theory.

The milk from the tuberculous cows has been repeatedly subjected to microscopical examination for tubercle bacilli and has been tested also by animal experiment. All tests have been negative with the exception of one animal. This work continues. Much time is devoted also to the determination of temperature which will kill the tubercle bacilli in milk. This subject provokes much interest because there is so much diversity of opinion concerning it, and is one which certainly should be settled beyond doubt. Furthermore, we have fed milk which had been artificially infected with tuberculous material to hogs with very satisfactory results; besides studying this milk so infected as to the distribution of the tubercle bacilli in the different products made from it.

Our attention has been peculiarly drawn to the possible dissemination of tuberculosis by means of the feces. Mysie 44, Shorthorn, the only one of the condemned animals, evacuated rich fecal matter. The bacilli are a constant quantity. With this as a starting point, we shall try to ascertain the effect of sunlight and weather in the destruction of these bacilli and also to find the time of their persistency. From some of the indications we would infer that this method of transmitting this disease among cattle cannot be disregarded.

The urine has been studied faithfully but with negative results in every instance; yet we feel that there is danger of spreading the disease in this way. Tuberculosis of the urinary organs is not so common as other forms, yet it exists, but to what extent we are unable to say. We are trying to learn how frequently it occurs.

What opportunity we have had to study the sputum, has furnished us with encouraging data. There is evidence of tubercle bacilli existing in nearly all cases of pulmonary tuberculosis.

The examination of water, air and soil is made from time to time as required to follow the disease through its various avenues.

The question of normal temperatures has been raised in connection with the tuberculin test. The study of normal temperatures under the same conditions as the regular test has recently begun. The results thus far indicate that this will prove a very valuable line of investigation.

The preventive and curative phase of the disease is to receive much consideration. Bacterial products and other agents are under test, but since nearly every chemical substance used in medicine has been repeatedly tried by clinicians, there is faint hope of doing anything with such curative agents. Much has been expected from bacterial products

by investigators, but the method of application and treatment is still a matter of mystery. Effort is made in several places by competent workers to discover a practical immunizing or curative substance manufactured by the tubercle bacilli in the process of their growth; and judging from what has been done, we are anticipating a probable solution in the future.

So much stress has been placed upon hygienic treatment and so much good has resulted, that we feel assured in making an attempt to benefit and completely cure a part of the cattle condemned by giving strict attention to their hygienic surroundings. All of the cattle are under hygienic treatment. Experiments, if they may be so called, are under way to ascertain the per cent of calves from tuberculous cows succumbing to tuberculosis. We believe that our evidence will be the same as Bang's in this respect: that it is possible to grow a sound herd from a tuberculous herd if proper care is used. We might sum up the experiments in progress with the condemned animals in the following general manner:

1. The bacteriological examination of milk and products.
2. The bacteriological examination of urine.
3. The bacteriological examination of feces.
4. The bacteriological examination of sputum.
5. A careful study of the tuberculin test upon condemned animals.
6. Hygienic and other treatment.
7. The value of off-spring from tuberculous cows.

Four bulletins have been issued from the bacteriological laboratory during the past year.

No. 139, "Bacteria, What They Are and What They Do," treats of bacteria in a very general way. Its purpose is to pave the way for bacteriologic reading and to give the readers of station bulletins an insight into the bacteriologic world. No attempt was made to give an exhaustive treatment of any chapter in bacteriology.

No. 140, "Ropiness in Cream or Milk," gives the results of investigation with a bacillus which was causing serious damage to a dairy-farm. The farmer's dairy was attacked by a bacillus during a hot, sultry spell in the summer of 1896, and rendered his milk unsalable. He was realizing about one hundred fifty dollars per month. This bacillus was isolated and studied in the laboratory. In the spring of 1897 the same trouble appeared again in the same dairy, when it was located in the dust of the stable floor. By this time we were ready to suggest a remedy which was followed faithfully and successfully during the summer, and practically without cost to the farmer.

No. 146, "Bacteria and the Dairy," considers in a very brief manner, the possible changes produced by bacteria acting upon milk, how they gain entrance to the milk and how they may be kept out. Suggestions are made in regard to their utility and to their pestiferous depredations.

No. 147, "Pasteurization of Milk," is a semi-technical analysis of the Pasteurizing process, based upon extensive laboratory work with the resistant bacteria usually found in milk.

We have examined many specimens of milk, water, etc., sent in by farmers, during the course of the year.

CHAS. E. MARSHALL.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1897.

REPORT OF THE APIARIST FOR 1896-7.

WORK AT MICHIGAN'S EXPERIMENTAL APIARY.

BY R. L. TAYLOR, APIARIST.

THE HIVE.

There is perhaps no point relating to bee-keeping about which I am asked so many questions as this.

It is well to understand that the bees themselves are not much concerned about the characteristics of their hive, they will make as much honey, other things being equal, in a shoe-box or a nail-keg as in a hive of the latest pattern or patent. So the form of the hive is a mere question of convenience to the apiarist. He may shape it so as best to secure the object he has in view. But bee-keepers have many objects, so hives are wanted: 1, for catching moths; 2, for pleasure; 3, for preventing swarming; 4, for producing bees; 5, for wintering bees; 6, for rearing queens; 7, for producing extracted honey; 8, for producing comb honey.

Fortunately, a different kind of hive is not required for each of these objects; if a hive is to be selected for one object, an eye may be had also to points calculated to secure other objects that are subsidiary and yet necessary to the full attainment of the main one, thus, whatever the main object, the hive must be such that it will prove as little fatal to the bees in winter time as possible. Still, no particular hive is likely to prove the best for all purposes.

The numbers of those who delight in hives simply on account of their moth catching qualities are of course small, but as there are some whose chief pleasure and occupation in life is to tame mosquitoes and train fleas to perform tricks, we are not to be surprised that there are some whose chief consideration it is to trap wax moths. It might be well if all of that type of bee-keepers were confined to moth trapping.

To be classed with these are those who keep bees and select hives for pleasure only; not that they are equally eccentric, but because the prescribing of hives for each of these two classes is alike outside the lines of apiculture proper.

Intermediate between these two classes and those that have an eye strictly to financial returns are those who are intensely interested in non-swarming, producing bees and in wintering bees. I call these intermediate because a part of each class is so passionately absorbed in inventing or otherwise securing or in testing a hive specifically adapted to the attainment of one of these ends that all interest in the primary objects of bee culture are so lost that they fade out of view, (who has not met those who are in ecstacies over their large or frequent swarms, yet who either forget to put on the surplus boxes or to take them off) while the other part make these objects more or less subsidiary to the attainment of the proper rewards of bee keeping. The first part of these classes must be relegated to a place with those who are pursuing pleasure and moths; with the hope, nevertheless, that by chance some device may be hit upon by them sometime that will be found worthy to be incorporated into the mass of real value to apiculture while the latter part will receive

such brief attention in connection with hives for honey production as my limits will permit.

While queen rearing is a legitimate department of bee-keeping, yet the characteristics of the hive best adapted to that branch is of special interest to so few, that I would not be warranted in taking time on the topic, even if I could hope to make any valuable suggestion touching it. The hive in use for other purposes will generally be found sufficiently serviceable for this one.

This brings me to the important point of this subject, the hive best adapted to the production of honey. I confine myself to a discussion of the brood chamber and that chiefly in relation to general principles.

The successful production of honey is the one overshadowing object of apiculture, and to this in my estimation all others ought to be made unhesitatingly to bow.

For my use, at least, there are certain qualities which a hive for this purpose must not possess.

1. It must not be expensive. Fifteen or twenty cents should purchase lumber enough of sufficiently good quality for body, cover and bottom. Lumber called "shipping culls," of white pine, is good enough for the body and a grade or two better will do for covers and bottoms, if the best of it is selected for covers. The apiarist must not be seduced by one or two good crops into failure in point of economy.

2. It must not be cumbersome. Its bulk and weight should be as small as may be, loose parts and projections should be avoided except where that is impossible. A hive that cannot be handled easily by one man when it contains a colony of bees with stores enough for winter is, as a rule, to be shunned. There may be an exception where the hive is seldom or never to be moved summer or winter. Even the risk of the displacements of the combs would, I think, better be obviated by fixed frames.

3. It must not be complicated. Slides, drawers and such like traps never work well inside of a box occupied by bees, and if they would, they could hardly accomplish anything which may not be more easily attained by simplicity.

Besides these negative points there are, in my view, some positive qualities to be sought for in any hive at all well calculated for an apiary to be conducted for the highest net profit. The first and most important of these is that the hive be fitted to conveniently repress the production of bees that can only detract from the net income. No doubt there are localities where, on account of the continuous character of the honey flow, or from the fact that the late crop is abundant and equally valuable, or nearly so, pound for pound, with that of the early crop, this matter may not require consideration, but in localities like central Michigan where the June and early July honey from white clover and basswood is nearly twice as valuable pound for pound as that gathered in the fall; and where the fall crop is generally scant or entirely wanting, and in any case a period of thirty or forty days of entire dearth between basswood and fall flowers, it is of the first importance.

I have heretofore attempted to show, and have, at least, about convinced myself that it costs two lbs. of honey to rear one pound of brood, and that as a Langstroth frame is capable of containing two pounds of brood, therefore, I hold that one such frame of brood costs four pounds of honey. Moreover, it needs no argument to show that five such frames

will contain sufficient brood to keep the colony up to the highest strength desirable in this locality for fall and winter purposes. Suppose now the clover and basswood season ends here, any given year, July 15th, it is evident, since it requires thirty-five days from the laying of the egg to mature a field worker, that all eggs laid in any colony in excess of the number required to keep comb to the extent of five L. frames supplied with brood can produce no bees that will prove of any practical utility. During these thirty-five days—the height of the season—average queens if allowed room, will keep eight frames filled with brood, and as it is for nearly one and three-fourths generations, the total excess over the required five frames would amount to about five frames during the thirty-five days at an expense of twenty pounds of honey or in an apiary of one hundred colonies a matter of $200 to $250. If space permitted it would be easy to mention one or two other items that would make the amount considerably more. It would be comparatively easy to select a hive that would secure the repression, if it were permissible at no time of the year to allow more than five L. frames of brood, but it is just as imperative that every cell possible be used previous to June 10th as that unnecessary brood should be prevented after that date. The selection of a hive must be made, therefore, first, with reference to the earlier period.

In the production of extracted honey the size of the hive during this period would not be very material, as honey in combs at the side of the brood nest would be about as valuable as that in combs above it, but for the production of comb honey it should be of such size as to give as nearly as possible merely room for the brood and thus secure the storing of the honey in the sections where it will be of double value. In this locality only a small proportion of colonies would occupy more than eight L. frames with brood prior to June 10th, so I deem a hive of greater capacity than that objectionable for the production of comb honey. If the field were lightly stocked with bees so that as large an increase as possible were desirable for the gathering of the crop, each queen could be given abundant room for the display of her powers by exchanging combs between the stronger and weaker colonies.

This line of thought would seem to fix our choice of hives on the eight frame Langstroth, but it has points which fail to give satisfaction when it is proposed to put contraction in force, about June 10th. Still this contraction, which, in practice, is largely confined to swarms, can be accomplished with this hive by removing three of the frames and filling the vacant space with dummies. This accomplishes the desired contraction but it also contracts the upper surface of the brood nest. This is not desirable, since, for the best work in the sections, it is necessary that the heat and the aroma of the brood nest should ascend freely to all parts of the section case.

At this point I am sometimes moved to pray those who are so sure they can breed the swarming instinct out of the bees, to breed out also the disposition to build combs perpendicularly and bring them to build their combs horizontally. With this accomplished we would have the perfection hive indeed—simply frames piled horizontally on the top of one another with the ability to make its capacity suit the colony or the apiarist by simply removing or adding frames without in any way affecting the desirable qualities of the hive. If this should fail will some one give us a hive composed of sections about three inches in depth which may

readily be placed one above another without bee-spaces between them and yet without crushing bees. I want them so they could be easily furnished with foundation for the combs but I would not care to have the combs movable. In the absence of this we have as the nearest approach to it the Heddon hive with sections approaching six inches in depth. The sections have bee-spaces but the spaces are not undesirable when the sections are of that depth. As each section of this hive has the capacity of five L. frames it answers excellently for the purposes of contraction but for most colonies previous to the period of contraction, one section is too small, and two are too large to satisfy me fully. I am sometimes inclined to think that if a portion of the sections were of the depth of about three inches they could be combined with the others in a more satisfactory way.

Without entering into further details I have sufficiently indicated the characteristics which I think the hive to be adopted should possess so let it suffice to say that either of the hives indicated will answer equally well, with any other, all the other legitimate ends of the apiarist.

THE ASPINWALL NON-SWARMING HIVE.

I have now used two of these hives in my apiary for the past two seasons, and yet the results so far as determining the true value of the non-swarming quality is concerned, are thus far negative. While other non-swarming devices that I have subjected to practical use have proved rather provocative of swarming than otherwise, this one has, at least, not failed to that extent, for, as yet, no swarm has issued from it Whether this result is to be ascribed to the virtue of the device itself, or to other circumstances, requires further use under other conditions for full determination.

The hive is a marvel of ingenuity throughout. The frames are of L. size, with closed ends, and, are held compactly together by a screw which works against a movable side. By the use of blocks to reinforce this movable side the size of the brood chamber is made elastic to a considerable extent. The provision made for ventilation is unique, and very effective, which no doubt renders material assistance to the main device for preventing swarming. The hive itself is a frame rather than a box, and has the bottom and only one end and one side fixed, the other side being movable as already explained, and the closed ends of the frames supplying the other end. The cover is a cap or box open underneath only, of sufficient dimensions to inclose two ordinary section cases when adjusted to the hive.

I make no attempt to describe, nor even to mention, the many fine points of the hive. In my estimation as now made it is too heavy, but I speak with reference to my own methods. I cannot tolerate a hive which a single able-bodied individual cannot pick up and carry to the cellar or to any part of the apiary without much discomfort, even when it is abundantly supplied with winter stores. This hive is not constructed with a view to portability. To one whose methods do not require this quality, this, of itself, would be no great objection, but there are other features of the hive which can scarcely fail to prove themselves inconvenient to every one who makes use of it. Under this head comes first, its bulk,

which is twice, not to say three times, as great as that of an ordinary single wall hive. There is plenty of room, of course, for this bulk in most apiaries, but when transportation by wagons or cars becomes necessary, one half or two-thirds of the space it requires will be greatly begrudged. After that, but first in importance, is the item of cost of construction. It will be said that the cost is not great and this in a certain sense is no doubt true, for one making large numbers with special machinery adapted to the purpose, and buying material at wholesale rates, could turn them out surprisingly cheap, but when he came to sell them each one helps pay for his special machinery and his special market advantages, so I say that, in a comparative sense, they are costly. I think my estimate is quite within bounds that the bolts, screws, castings and other metal of this hive would equal an entire plain L. hive in cost; that the lumber would cost twice as much, and the labor of making more than twice as much, so that the cost would be at least one hundred and fifty per cent in excess of the L. hive, or two and one-half times as much, and all this without considering the device for prevention of swarming which is the chief and important distinguishing feature of the hive. These present times of low prices, short crops, slow sales and small profits speak too eloquently in the ears of the producer, of the necessity of curtailing expenses to the last possible mill, to require dissertation here on the virtue or necessity of economy. Then comes the nicety of the work required in reproducing some of the fine points of the hive, as, for instance, the somewhat eccentric character of the ends of the brood frames, without any compensating advantage. As a rule, bee-keepers cannot afford to purchase hives, they must make them, hence the necessity of simplicity of construction.

Fortunately, none of the points to which exception is taken, are, in my view, necessary to the employment of the crowning device of the invention without diminished effectiveness. By this device, viz., that for the prevention of swarming, a large percentage is added to the roominess of the brood chamber, without increasing the space which can be occupied by comb. This is accomplished, roughly speaking, by alternating, at the approach of the swarming season, the combs of the brood chamber with frames of wooden comb, which has no septum, and in which, consequently, nothing can be stored. This comb appears as if it had been made in this way: sections one-half inch in thickness taken from the end of a basswood plank, which has first been perforated lengthwise with a set of one-fifth inch bits set as closely together as could safely be done without endangering the stability of the walls between the perforations, are treated with some substance to make them proof against the bees and the weather and then fitted into appropriate frames. It will at once be seen that this arrangement must give the bees the feeling that they have an abundance of room, since, if the ordinary combs are filled with brood and honey, in addition to the cells of the wooden combs which must remain continually empty, and which yet probably give the bees the impression that they are to be filled, the vacant space in the brood chamber is nearly or quite doubled. It is claimed that this not only prevents swarming but contrary to what might be expected, there is a decidedly less inclination to store honey in the brood combs and consequently much more is secured in the supers.

As already said, in the two season's use, I have had no swarms from

these hives but, during the first season, swarms from ordinary hives were exceedingly few, and during the last season one of the colonies had a queen of the current year's production, and the other was not strong enough, owing to the scant flow of nectar, to secure any surplus. In consideration of these circumstances the coming season is looked to for more satisfactory results.

BEES AND GRAPES.

As between fruit growers and bee-keepers there is no more important question than this; do bees injure fruit? There is no question during any time of summer when the flowers secrete little or no nectar, that bees suck the juices of broken fruit, but it is contended on the part of a considerable class of horticulturists that the bees actually cut through the outer covering of grapes and some of the small fruits, and thus do great damage to the fruit growing interests. Some are very positive on this point, affirming that they know they do, having actually witnessed the operation. I feel some sympathy for this class, since, at one time, though familiar with all the arguments against that opinion, I was half inclined to believe that in some way sometimes the bees forced open the skin of grapes. For some years I have been greatly interested in the production of fine grapes and when at times I saw the bees crowding their heads down between the berries of fine compact and apparently perfect clusters of Delawares, and afterwards found that many of the berries were sucked dry, and would fall off with a touch, my faith in the inability of the bee to break the skin of the grape suffered a severe wound. I could easily see, in the case of the Lady grape, and some others, which frequently crack open extensively from excessive moisture, since the cracks were evident and the cause certainly known, that the bees had no agency in making the openings; but in the case of the Delawares no such ruptures were evident. Continued investigation convinced me that the skins of different varieties of grapes crack in different ways, that is, some crack, so to speak, longitudinally, and some crosswise and that they also crack from a somewhat different combination of causes. These as I judge, are three; moisture from without, moisture from within, and external pressure. Moisture alone, in my experience, seldom causes cracking, or, rather, I should say causes it only to a small extent. Certain tender-skinned varieties, as the Brighton, when the bunches hang in clusters so as to prevent the ready evaporation of moisture caused by the frequent rains, suffer some, but, perhaps, rather from decay of the skin; and, apparently, the berries of any variety if they lie on the ground in a wet season or upon any other substance that retains moisture, crack more or less. Other kinds, as the Lady, crack to a limited extent on account of moisture from within, that is, from the superabundant flow of sap which takes place during a time of frequent heavy rains. But very much the larger part of cracking is caused by this unusual flow of sap in conjunction with the pressure of the berries upon each other, that is, in the compact clusters. In some varieties, however, the grapes have a skin of such toughness or elasticity as to successfully resist these joint forces. The Ulster and the Niagara are of this character. I have never known these to crack, and the greatness of the force which the skin resists is seen in the fact that in these, and other varieties, as they grow here, it is not uncommon to find, before the ripening season begins, berries which have been pulled from the main stem of the cluster by the crowding force of their neighbors. Upon

these grapes and others like them, in the characteristic mentioned above, I am satisfied the bees never work, unless the grapes are first broken by birds or otherwise, evidently not the work of bees. On the other hand, the Brighton is an example of a grape with a very tender skin which, nevertheless, never cracks here beyond an insignificant amount, owing to the fact, as I claim, that the clusters are, as a rule, not very compact, and, though it is a grape of the highest quality, with a very tender skin, the bees have no more success in gaining access to its juices than they have to those of the tough skinned Ulster. Of the more than thirty varieties I have in bearing the work of the bees has usually been confined almost entirely to the Delaware and the Lady, but, on account of the wetness of the season, the Duchess and the Salem must be added this year, and these are the ones also to which cracking is almost exclusively confined. In point of compactness these kinds stand in the following order: Duchess, Lady, Delaware and Salem. Most of the clusters of the Duchess on strong vines are exceedingly compact, while those on young vines or those lacking in vigor are quite loose. The Lady has most of its fruit in compact clusters which, with its brittle skin, seldom fails to render it almost worthless here on account of its cracking. A fair share of Delawares are quite compact, and from one-third to a half of the Salems are only less so.

The significant fact here is that the work of the bees was confined to the compact clusters while the loose clusters neither cracked nor were visited by bees.

In all these varieties except the Delaware the cracks, a half inch or more in length, were plainly visible and evidently the work of natural causes. As to the Delaware, one might say on a hasty examination that they do not crack, for the cracks are never in sight so long as the berries remain in the cluster, but an examination with some little care will show that they do crack transversely near the stem end of the berry. The Diamond grape is affected in a similar manner when it cracks at all.

The line of thought and investigation of which the above is a rough outline convinced me that bees never injure grapes. Still, the thought that many would not thus be convinced led me to seek some further test. Heretofore all manner of experiments have been made to induce, if possible, bees to break the skin of perfect grapes, such as placing clusters in hives, confining bees with grapes, etc., from which only negative results were obtained. Entomologists have studied the mandibles of the bee and declared that they are so little adapted to the purpose of piercing the skin of a grape that it would be entirely impossible for a bee to use them with effect in that way. On many minds these arguments had little effect.

In July last the rainfall being so great that more than the usual amount of the cracking of grapes might be expected, so I decided to determine if possible whether grapes from which bees were excluded, but still left hanging upon the vines, suffered in any different degree from those to which the bees had free access. To shut out the bees paper sacks were used. These were folded closely about the stems after being drawn over the clusters and fastened with common pins. A small slit was cut in the bottom of each sack to permit the escape of any water that might gain admittance. Upwards of one thousand sacks were put upon the thirteen varieties hereinafter mentioned. Many of these became ripe early in

September and by September 24th all were ripe except Jefferson and Iona. As already intimated the damage was considerable, becoming evident even before maturity. The results will sufficiently appear from the following table:

	Amount of Damage.			Amount of damage.	
	In bags.	Without bags.		In bags.	Without bags.
Agawam	None	None.	Iona	None	None.
Brighton	None	Little.	Jefferson	Very little.	Very little.
Delaware	Much	Less.	Lindley	None	None.
Diamond	Little	Little.			
Duchess	Much	Less.	Niagara	None	None.
Eaton	None	None.	Salem	Much	Less.
Eumelan	None	None.	Ulster	None	None.

In the case of the three kinds much injured it became constantly more evident that the damage to those in the bags was greater than to those to which the bees had access. This was especially true of the Duchess and the Delaware. So evident was it that the reason of this lay in the fact that the juice oozing from cracked grapes in the bags was communicated to neighboring grapes causing incipient decay, a weakness of skin and cracking where otherwise cracking would not have occurred, that by the middle of the month I hastened to remove the bags from these varieties that the bees might gather the juice from the broken grapes.

To my mind the conclusion is inevitable that not only do bees not injure grapes but that by gathering the juices of cracked ones they prevent decay and thereby the destruction of sound grapes.

FEEDING BACK.

It has been thought worth while to repeat the experiment of feeding back extracted honey for the completion of unfinished sections. It has also been found more convenient and desirable to do so owing to the fact that the character of the season has been such that the percentage of partially filled sections has been greater during the past season (1896) than ever before. This was owing to the shortness of the honey season and the slender character of the honey flow. The extent of this was such that but now and then a colony completed even one case. For the purposes of the experiment four colonies were selected. All were hybrid bees, so-called, and very strong. For a brood chamber, each colony was given a single section of the Heddon hive containing frames equal to five Langstroth frames. Doubtless a brood chamber even smaller, perhaps as small as two and a half L. frames, would have been better, and this for two reasons. First, much less of the honey would have been required for the rearing of brood, as the extent of that would have been reduced by one half. I have heretofore given reasons tending to show that it requires two pounds of honey for the production of one pound of brood and that a section of the Heddon hive, if almost entirely devoted to brood, would contain about ten pounds of it. If this is substantially correct, it will be seen by consulting the table presented herewith that twenty pounds of honey would be required every three weeks to produce the brood of each of the colonies used in this experiment. This amount of

brood might have been reduced by one-half without detriment to the well-being of the colony, and one-half the honey saved. Second, what I have just said appropriately introduces this point. The number of bees continually hatching from five L. frames full of the brood constantly increases the strength of the colony so that if feeding is continued any length of time, with the crowding necessary for the production of comb honey, swarming is induced. This would be detrimental to the highest success of the work. With about half that amount of brood the strength of the colony would be kept good and swarming avoided, for it must not be too readily accepted that a small brood chamber without reference to the degree of smallness conduces to swarming.

The feeding was begun the 15th of July soon after the closing of the flow from clover and basswood. Two or more cases of sections were kept upon each colony and the honey given as rapidly as the bees would take it. The honey was prepared for feeding by thoroughly incorporating with it about one-half its own weight of water on the supposition that in this condition the bees would handle it more rapidly.

The work with colonies two, three and four was closed August 6, one day more than three weeks, owing to the fact that on that date or shortly before they had cast swarms, rendering it undesirable to continue them in the work. Colony No. 1 was retained in the experiment until the 29th of August, nearly six and a half weeks. This colony was particularly adapted to comb building and showed that, during the first half of the period, but later owing probably in part to the low temperature which prevailed during August, its work was less satisfactory.

Up to August 10th there was no noticable amount of honey coming from the fields but later there was some considerable being gathered, though colony No. 1, being fed, seemed to participate to a very small extent in it, not bringing enough to tinge the color of the comb honey in process of construction, and so I judge not sufficient to make it an appreciable element in the problem under consideration.

No. of colony.	Net weight in pounds of unfinished sections put on the hives.	Amount fed, in pounds.	Amount of honey, in pounds, when completed.	Gain in pounds.	Per cent. of gain to amount fed.	Pounds of honey fed for each pound gained.	Gain in honey in brood nest.	Per cent of gain to amount fed, with honey in brood nest considered.	Heddon frames of brood July 15th.	Heddon frames of brood at the end of the experiment.
1	225	168½	317¾	92¾	55	1 81	10¼	61	7¾	6½
2	62	76½	111½	46½	64 7	1 54	¾	65.7	8	8
3	99¾	75	136	36¼	49	2.04	5	55 6	8	6½
4	66	67½	114½	48½	71.9	1.34	½	72 5	8	8
Total	452¾	378½	679¾	227½	58 7	1.70	16½	63	......	....

Turning now to the table we find some questions presented which are not altogether easy to answer. We find there so striking a difference between the work of colonies as that one requires more than two pounds of honey to enable it to add one pound to its store of comb honey while another requires but a trifle more than a pound and a third. It might be surmised that the one requiring the larger amount had expended it

in the production of a larger amount of brood. If, however, we allow that No. 3 reared an amount of brood equal to that reared by No. 4, viz., eight H. frames full and deduct from the amount fed each the twenty pounds supposed to be necessary for the rearing of the brood we see No. 4 accounts fully for all the remainder in its case, while No. 3 lacks eighteen and a quarter pounds of doing so. In like manner, on the above supposition, No. 2 accounts for nearly all the honey given it, while No. 1 comes short of it by more than thirty pounds. It can hardly be that the amount of honey required by different colonies for the rearing of the same quantity of brood can vary very greatly, nor the amount required by the adult bees for food where the strength of the colonies is about equal. At present I see only two other ways of accounting for the deficit, viz., quiet robbing and varying amounts required for the production of wax. Robbing as an outlet is hardly to be relied upon: wax production seems more likely to afford some measure of relief. If the table is examined closely it will be seen that the sections given Nos. 1 and 3 averaged much heavier than those given Nos. 2 and 4. Can it be then that the much greater proportionate amount of cappings of the honey to be done in the one case calls for the production of wax for use in the capping as to account for the apparent discrepancy? It may in some measure, and, besides, some colonies may practice putting more wax into a given extent of comb so as to make it stronger and safer. It is plain there are abundant subjects yet for investigation in bee culture. Figures may be made in different ways to determine the amount of profit there is in feeding back. I consider the value of the unfinished sections as about equal to that of the extracted honey, say six cents. This would make the value of these two articles entering into this experiment $50.38 cents. I compute the value of the 679¾ pounds of comb honey produced, at 12 cents per pound which gives a total value of $81.57, or a profit of nearly 62 per cent.

HIGH TEMPERATURES IN CELLAR WINTERING.

Aided by the unusually mild winter, and by putting a large number of strong colonies in my bee cellar, I have been enabled to some extent to test the effect of a high cellar temperature for wintering bees. I was the more resigned to the risk supposed to be incurred by making such an experiment on account of a belief that a high temperature induces conditions that aid the bees in avoiding much of the ill effects of the common winter disease the advent of which was anticipated on account of the large amount of fruit juices which was gathered during last fall by the bees. I succeeded beyond my expectations, indeed, beyond my desires, in securing a high temperature, for on several occasions it was with difficulty that I kept it down to 50 degrees by opening the outside door during the night. Even with this free ventilation it very seldom went below 45 degrees, and within a few hours it was back to 50 degrees. For a considerable part of the time the thermometer stood a little above 50 degrees, but for the greater part of the time at from 48 to 50 degrees.

The bees were put into the cellar comparatively early—from the 5th to the 13th of November. There were one hundred and eighty colonies, mostly heavy and strong. There were about twenty on L. frames, twenty or thirty in single sections of the Heddon hive and the rest in Heddon hives of two sections. All except those in single section H. hives were stored in the cellar without bottom boards. Notwithstanding the high

temperature the bees remained as quiet as is usual with the temperature 5 to 8 degrees lower. They were also free from any unusual appearance of the winter disease as well as from excessive loss of bees until about the last of February. From this time there was a marked change in both respects although the bees seemed to remain usually quiet. The number of dead bees on the cellar bottom increased rapidly—beyond anything I had experienced except in one disastrous winter, and about one-half of the hives became more or less spotted with excrement and about ten per cent excessively so.

On the 29th of March removal from the cellar was begun and kept up by taking a few out from time to time on favorable days until April 14, when the last, a baker's dozen, were placed on their summer stands. The examinations during and after the removal disclosed the following results: thirteen colones dead or so nearly so that the bees still living were of no value. I say dead, though three of the thirteen had left their hives and combs clean and free of dead bees and honey, showing that they had each probably united with the colony above or below, the honey being conveyed thither also. Two had starved, two had perished from weakness resulting from queenlessness, one with a bottom board had apparently smothered from the entrance having become clogged and the rest had apparently died of dysentery. The dead bees from the cellar floor measured six well packed bushels amounting, I estimate, to a loss on the average of three pints of bees from each colony. Moreover, there had undoubtedly been considerable breeding during the latter part of the winter as was shown by the remains of immature brood and imperfect young bees among the debris that had fallen from the hives. On removal from the cellar the bees from most of the colonies spotted their hives and surrounding objects on taking their first flight, yet they were clean and seemed strong both physically and numerically—most of the colones being of about the same strength as when placed in the cellar. In most of the hives also, containing plenty of stores, there were at the time of removal considerable amounts of capped brood, and in one strong colony was discovered a nice patch of capped drone brood.

What the full effect of this cellar breeding will be remains to be seen for it is yet too early to pronounce a safe judgment. For a long time I have felt a fear that there was a store of evil laid up in the future for colonies guilty of breeding in confinement, but I have had heretofore no case that would serve so satisfactorily as a test as the present one and I shall look forward with considerable interest to the outcome.

One other result of warm wintering remains yet to be noticed, and that is the amount of stores consumed. I can only show this result in the case of poor to medium colonies, for those of this class only were weighed in the fall. It is necessary to bear this in mind because the stronger the colonies the greater will be the average amount consumed. The results in brief on this point are as follows: eleven colonies in two section H. hives averaging in the fall, shortly before being put into winter quarters, 50.72 pounds averaged in the spring 35.27 pounds, showing an average consumption of almost fifteen and a half pounds. The heaviest colony of this lot consumed 21 pounds, and two others 19 pounds each. Seven other colonies in single section H. hives weighed on the average in the fall 40.78 pounds, and in the spring 29.07, showing an average consumption of nearly eleven and three-fourths pounds.

This is a consumption of stores of from fifty to one hundred per cent in excess of anything I have heretofore known when the bees had in my estimation wintered tolerably well. Of course if this extra consumption results in an appreciable advantage to the colonies it is well, but if it causes also an abatement of the vitality of the bees it is greatly to be deprecated.

In conclusion it will be noticed that I took out the bees much earlier than is usually recommended, for there were no signs yet of the opening of soft maple blossoms, the time which is generally set as the most desirable for that operation. The greater my experience the more I am inclined to the desirability of early removal from winter quarters. When most good colonies stand exposure, without extra protection, to the weather of the entire winter, it would seem that it should go without saying that any colony should stand the vicissitudes of early April without serious injury, and I have found, at least to my own satisfaction, that it is so. There are several substantial advantages in early removal:

1. There is much greater comfort in the labor of removal.
2. A few only need be taken out on any one day.
3. There is little or none of the crazy out-rushing and commingling of the bees of the different colonies.
4. The bees settle down to honest work more quickly and permanently and
5. The beginnings of attempts to rob are much more easily and effectively prevented, and much vexatious watching is thereby rendered unnecessary.

Since the preceding concerning high temperature in wintering was written sufficient time has passed to warrant me in saying that the rearing of brood while in the cellar apparently proved to be no detriment to the bees, though at the same time it is doubtful whether it was of any advantage.

COMPARISON OF SECTION COMB FOUNDATIONS, 1897.

Comb foundation bears about the same relation to the apiarist as commercial fertilizer is to the farmer who is compelled to use it. In each case the quality of the article has much to do with the success and prosperity of the class using it. It is of the utmost importance, consequently, that purchasers be informed in so far as may be of the character of the goods offered for sale by different dealers, which will result not only in present safety to the purchaser but also (and this is perhaps even more important) compels manufacturers continually to make every effort to keep the quality of their product at the highest possible point. It is therefore deemed desirable that the experiments heretofore made with comb foundation should be repeated and this has been done during the seasons of 1896 and 1897.

It is all the more important that these experiments should be continued, because new methods are from time to time being learned and practiced in the manipulation, and it is of the highest interest that it be known if possible whether the methods affect the product favorably or otherwise. During the past year, especially, there has been a marked change in methods by the adoption by our leading manufacturers of the Weed invention. This is a machine the most important feature of which seems to be the contrivance by which melted wax is made into

sheets of any length by being passed between cylinders. The immediate object of the present experiment was to test the quality of foundation made by this new process.

As a basis for comparison I made some foundation on the Given Press out of wax carefully selected for its purity, color and favorable texture, the effort being directed to the selection of wax known to be most acceptable and most readily worked by the bees. The samples compared were three, one from the largest manufacturer in this State, M. H. Hunt, Bell Branch, Mich., which was made by the method heretofore in vogue, and the other two respectively from the two leading manufacturers of this country if not of the world, the A. I. Root Co. of Medina, Ohio, and Chas. Dadant & Son, of Hamilton, Ill., made by the new process. One case was devoted to the three kinds, that is each case of a size to contain 36 sections nine to the foot was filled with sections one-half of which contained one of the above three kinds and the other half the Given foundation. The two kinds were placed in the case alternately without separators, the presumption being that those containing foundation worked soonest and most readily by the bees would at the finish contain more honey than the others.

For the benefit of those who have not perused the reports of former experiments it should be said that it is deemed very material to the success of an experiment of this nature that the sections employed be about nine to-the-foot or one and a third inches wide, for the reason that this width approximates very nearly the space which the bees like best to allow each comb. To be exact, this space is somewhat less than the bees use on an average, but a departure on that side is desirable, as appears if the difficulty encountered by the use of sections that are too wide is considered. I found by actual trial if two kinds of foundation for one of which the bees have a decided preference are disposed in a case in alternate sections, having each a width of nearly one and three-fourths inches, or seven-to-the-foot, that at first the bees work out the preferred foundation much more rapidly than they do the other and continue to do so until the resulting comb is of the thickness which the bees prefer and must have for use in the production of brood, and that when this point is reached their work on it is, to some extent, suspended and an effort made to bring up the thinner comb from the poorer foundation, so that, with such sections, the preferences of the bees defeat the object of the experiment which is to have them deposit honey in the two classes of sections in proportion to the estimation in which they hold the two kinds of foundation, uninfluenced by their ideas of propriety on other points. But the use of sections nine-to-the-foot meets the required condition, for, unless one of the foundations is execrable indeed, the comb from the better one is not likely to reach the desired thickness before the available space is all occupied.

The results of the experiment appear in detail in the following table.

In each case the Given foundation, as generally heretofore, shows a superiority, but in a greatly reduced degree.

The sample from Hunt, whose foundation has heretofore, in this kind of experiment, stood at or near the head, loses its place, though on the whole it compares more favorably with the Given than in the test of a year ago.

Make.	Size of foundation used—inches.	No. to the lb.	No of feet to the lb.	Weight of ¼ case of honey from each kind of foundat'n. lbs.	oz.	Per cent of excess of that made from Given foundation.
Root	3¾x3⅞	112	11.8	11	9	
Given	3¾x3¾	116	11.8	11	13	2.16
Hunt	3¾x3¾	128	12.7	10	15	
Given	3¾x3¾	116	11.8	11	5	3.42
Dadant	3¾x3¾	128	12.5	9	14	
Given	3¾x3¾	116	11.8	10	1	1.89

The showing made by the New Process foundation is very favorable indeed, a very gratifying fact, since the increased facility in manufacturing gained by the new method will have a strong tendency to decrease the price of the product.

It is another matter for congratulation that the samples of foundation used in the present experiment approach uniformity very much more nearly than ever before.

TESTS OF COMB FOUNDATION, 1897.

During the honey season of 1897, I tested several specimens of foundation from different sources. These consisted of two from the A. I. Root Co., of Medina. Ohio, thin and extra thin; two from a maker in Lansing, Iowa or Minnesota, whose name and exact address has been mislaid, thin and extra thin; one from T. F. Bingham, Farwell, Mich., and one known as drawn foundation, having very deep cells, from the A. I. Root Co. For comparison each of these was used in connection with foundation made on a Given Press, as in former experiments.

The weight of the several kinds was as follows:

The A. I. Root Co.'s extra thin 12.1 ft. to the pound.

The A. I. Root Co.'s thin 10.3 ft. to the pound.

The A. I. Root Co.'s drawn foundation 6.25 ft. to the pound.

Bingham's 11.3 ft. to the pound.

Lansing extra thin 14.8 ft. to the pound.

Lansing thin 11.7 ft. to the pound.

Given 9.4 ft. to the pound.

The drawn foundation is a very good imitation of new comb, just as it begins to be occupied by brood or honey, except that it is of a decidedly yellower color and the top of the cell walls is sharp as in the case of natural comb when the surface has been shaved off as in uncapping. The several kinds of foundations were all well made, but owing to the wax from which they were made some were very yellow—an undesirable characteristic it seems to me in foundation to be used in sections for comb honey.

In making comparative tests of foundations it appears to me there are three questions of paramount importance, viz.: Which do the bees work the most readily? Into which will the bees put the most honey in the same time under like circumstances? And which will they draw

out thinnest or most like natural comb? The first must be answered by inspection, the second by weighing sections of honey filled under the same circumstances, and the third by measuring with a proper instrument the thickness of the bases of the cells of the resulting comb.

To secure these answers fourteen sections were filled with foundation of each kind except the Given and the drawn foundation, then with each lot was put a set of fourteen sections filled with Given foundation and each lot of twenty-eight sections thus made up was put in a case by itself, the two kinds alternating throughout, thus making the Given sections occupy a position in the case corresponding exactly with that of the other kinds with which they were placed. Of the drawn foundation I had only sufficient to fill six sections, so the six thus filled were placed alternately with Given sections in a case as near the center as possible and the filling of the case completed with other sections. Each of the cases thus prepared was placed on a colony of bees during the honey season and all the sections were worked more or less, but not sufficiently so that the test by weighing could be made with any satisfaction.

By inspection, however, the preferences of the bees were readily discovered. In this respect the case of the drawn foundation was curious and is worthy of mature consideration by all who contemplate making any use of this sort. It was used at once almost for storing honey and it appeared then that it would be ahead of the plain foundation at the time of capping in point of weight, but such did not prove to be the case. At the end of the honey flow, when the center sections were beginning to be capped, a drawn foundation section right in the center of the case weighed only 70 per cent as much as the Given section standing next it. It seems probable that this unexpected result was due either to the fact that the bees were dissatisfied with this imitation of comb and used it only for the reception of honey until they could provide other receptacles, or else to the fact that having only the six sections capable of holding honey at once, they put so much thin honey in them at the outset as to delay the process of evaporation to such an extent that these sections in the end appeared at a disadvantage. If this result was owing to the dissatisfaction of the bees this sort of foundation must apparently be condemned, but if owing to the other ground given, condemnation would not necessarily follow, for if it were in regular use there would be twenty-eight sections instead of six in which to distribute the incoming nectar and it might well be that this greatly increased surface would enable the bees to cure the honey as rapidly as necessary. This is a point that touches the use of drawn comb in sections which on account of this drawback probably, has sometimes been condemned. Naturally more nectar is gathered when the comb is ready for its reception and it occurs to me that the number of sections given a colony under such circumstances should be increased accordingly.

As to the other sorts of foundation the two Root samples were worked at about an equal pace with the Given—the kind called "thin" perhaps a little more rapidly. The Lansing "thin" was behind the Given in that respect and the Bingham and the Lansing extra thin were behind in a more marked degree.

To determine the thinness to which the bees worked these foundations, pieces of the comb made from them were cleaned and sent to Dr. Beal, of the Agricultural College, for measurement. I also sent pieces of comb from foundation used in my experiments in 1896, and a piece of natural comb. From five to twelve measurements were taken from each piece generally. Exceptions are found in the case of the Lansing thin, of which but two were taken, and in case of the Root thin, of which but three were taken. Allowance ought to be made these on this account, for in making up the table given herewith showing the results, I have made use of the three lowest measurements in each case as showing best the thinness to which the bees work each. The reason is here: As the bases approach the points where the side walls are attached they naturally become much thicker, and evidently measurements in many cases were taken at near this point. The number of measurements and the largest one in each case are as follows:

Root, extra thin	No. of measurements,	7.	Largest, 9.
Given,	" "	22.	" 15.
Lansing, thin	" "	2.	" 8.

TABLE OF MEASUREMENTS.

A. I. Root Co. Extra thin.	Given.	Lansing. Thin.	Given.	A. I. Root Co. Thin.	Given.	Lansing, Extra thin.	Given.	Bingham.	Given.	Drawn foundation.	Given.	Root, '96.	Dadant, '96.	Hunt, '96.	Natural comb.
5 6 6	3 6 6	5 ? 8 ?	4 5 5	8 ? 9 ? 12 ?	5 6 8	5 6 5	5 6 7	4 4 5	4 5 5	8.5 9 10	8 8 7.5	6 7 8	5 6 6	4 5 6	6 7 7
* 5.67	5	6 5	4.67	9.67	6.33	5.33	6	4 33	4 67	9.16	7.83	7	5.67	5	6.67

* Average.

Given,	No. of measurements,	8.	Largest, 7.
Root, thin,	" "	3.	" 12.
Given,	" "	8.	" 15.
Lansing, extra thin	" "	6.	" 8.
Given,	" "	3.	" 7.
Bingham,	" "	16.	" 10.
Given,	" "	6.	" 7.
Drawn foundation	" "	7.	" 20.
Given,	" "	6.	" 9.
Root, '96,	" "	4.	" 12.
Dadant, '96,	" "	5.	" 9.
Hunt, '96,	" "	5.	" 8.
Natural comb,	" "	6.	" 10.

All the measurements are in thousandths of an inch. Dr. Beal writes that the measurements are correct, but that too much stress ought not to be put on them on account of the variations in the thickness of the bases, and I agree that they are not to be relied upon unless there is assurance that they are taken at points not affected by the junction of the side walls.

The following salient points in this experiment are to be noted:

1. The average of all the foundations tested, exclusive of the drawn foundation, appear by the measurements to have bases about eleven per cent thinner than those of the natural comb tested, which had every appearance of being an average specimen.

2. In point of thinness the Bingham foundation decidedly surpassed all others.

3. Making due allowance for the Root "thin," as suggested, the base of the drawn foundation was much the heaviest of any, exceeding that of the natural comb thirty-seven per cent; indeed, the difference was clearly perceptible to the naked eye on comparing the cut edges of the several septums.

DOES ALL OF THE HONEY IN A FOUL-BROOD COLONY CONTAIN GERMS?

Two cases of foul brood were discovered during the season of 1896. These were treated as heretofore by putting the bees into clean hives furnished with foundation and the diseased hives with their combs disinfected with heat. The treatment was completely successful, as has uniformly been the case heretofore. The two all-important considerations in the operation are that the management be so careful and guarded that no bees from the diseased colony be driven to other colonies and that no bees from healthy colonies be permitted to visit the combs of the diseased colony.

The reason upon which this caution is founded is that the germs of the disease are liable to be carried from the diseased colony to healthy ones in its honey—at least it is the supposition that there is such liability. We know certainly that robber bees when engaged in robbing a diseased colony carry the infection to their own hive. We are certain also that honey extracted from combs which have contained the diseased larvæ convey the disease to colonies that use it. But to have this effect it is not necessary to suppose that every cell of honey contains germs, and when we consider how small a proportion of the larvæ are freshly infected with the disease at any one time, and that the progress of the disease in a colony is generally quite slow, it is rational to suppose that but a small proportion of the cells of honey contains the germs. There would perhaps be an exception to this if a strong colony became badly affected with the disease towards fall, say in August, when its hive was well filled with brood and when a good flow of honey occurred in September, for in that case, in the ordinary course of things, as the dead matter of the larvæ dried down, the cells containing it would be filled with honey. It would seem inevitable then that a large proportion of the cells of honey should contain floating germs so soon as sufficient time were given to allow the honey to soften the dried matter. After this the cells containing affected honey may be largely increased in numbers by the removal of the honey from cell to cell as in the spring when brood rearing is resumed.

Cheshire in his celebrated work laid it down as a scientific fact that the germs of foul brood were not to be found in the honey. This conclusion was not accepted in this country because it was found that practically at least it was not true. I doubt if Cheshire himself would deny that the germs could be mingled with honey by the hand of man, and if

they could then they also could, in the ways I have hereinbefore indicated, by the bees. With these exceptions, was not Cheshire correct?

This is a matter of considerable importance, because a true answer to the question would give us a pretty clear insight into the methods by which the disease in question may be disseminated. If Cheshire is correct, with the limitations suggested, then the disease cannot be conveyed by germs floating in the air or carried about on the bodies of the bees, otherwise they must certainly be carried to the honey in open cells throughout the hive.

With these thoughts in mind I made an experiment with honey taken from one of the colonies operated on. The colony was quite badly affected, there being in the space occupied by the queen from one-fourth to one-third of the cells that contained dead brood. The honey was contained in the two outside combs of the upper section of the Heddon hive. The combs contained five or six pounds of honey and had apparently never contained any brood. The honey was fed to a colony of moderate strength and very short of stores but actively engaged in the rearing of brood, by placing the combs in a story above the honey board, through which the bees came and carried the honey below until it was all gone, and evidently all or nearly all used in nourishing the growing larvæ.

In this experiment the thought was that if the honey contained the germs, that fact would certainly be revealed by the appearance of the disease among the brood below, and that the continued absence of the disease would be pretty satisfactory evidence that that honey contained no germs, and, consequently, in so far as one experiment goes, that they are not carried about by the action of the air nor upon the bodies of the bees. Several examinations were made of the colony during the latter part of the summer and early fall to discover the existence of foul brood if such were the fact, but no trace of disease was found.

If enough further experiments give the same results, a decided relief will often be experienced in dealing with the disease as where there are considerable amounts of surplus honey above the honey boards.

Continued observations have been made in the cases of two experiments which have been heretofore reported; one of these was the immediate introduction to a healthy colony of a queen taken from a colony so badly affected with foul brood as to be about worthless. Examinations the last season show that the colony to which the queen was introduced remained healthy, as had been anticipated from the fact that it had revealed no signs of disease the previous season. This seems to show pretty conclusively that a queen is not necessarily diseased herself though she has been for a long time in a badly diseased colony. The other one was the case of a colony of which mention has been made several times heretofore, in which what to all appearance was foul brood showed itself without making apparent progress, disappearing altogether at times and reappearing again to the extent of a few cells only. During the last season it did not show itself in the colony at all. It would be of interest to know certainly whether this was a case of true foul brood, and if it reappears an effort will be made to have the point determined by a competent microscopist.

From reports that reach me, I judge that the disease to which bees are subject referred to in the foregoing is pretty widely disseminated through the State, and that ignorance of the methods of its detection and cure

exists almost as widely. I therefore venture, in view of the great importance of the matter and at the risk of some repetition, to append a description of

THE CHARACTERISTICS OF FOUL BROOD.

EXACTLY HOW TO DETECT IT; AND ALSO EXACTLY HOW TO GET RID OF THE DISEASE.

Where foul brood exists, or where its existence is suspected, it is of prime importance that one have the ability to distinguish it with certainty from every other disease or injury. Some degree of practical experience of the disease will alone make one an adept in discovering and identifying it, yet its peculiarities are so pronounced that no one having good eyes and nose and giving attention need be in any doubt in regard to its presence.

The one crucial test is the color and consistency of the dead larvæ, affected with the disease, before it dries up. At this stage the matter of the dead larvæ is always viscid or ropy like mucus. There is no foul brood without this characteristic, and I may safely say that with this characteristic there is always foul brood. This last statement, however, requires explanation. In my experience of ten years with the disease I conclude that in a few years it spends its force and loses its vitality in a given locality, while it continues to retain in the matter of the larvæ in a considerable degree the viscid character. In such case there is likely to be found but few affected larvæ in any colony, and with a little experience and care the two conditions are readily distinguished, and in this way: In the weakened stage the dead matter is slightly less viscid, but a better test is that it is paler in color. The dead matter of the larvæ affected with this disease in its vigor is of the color of coffee when prepared for drinking by the addition of a moderate amount of milk. In the weakened stage of the diseased the color is perceptibly lighter. To determine the consistency of the dead matter of larvæ, insert a sliver or a straw into it and then withdraw it. If the matter pulls out in a string, adhering to the sliver, and is of the coffee color described, it may be set down that foul brood is certainly present; but if it does not show this decided ropiness, it is just as certain that there is no foul brood in that cell.

I just said there is no foul brood without ropiness, but this must not be taken too literally. That was said with reference to the stage during which the matter remains soft. After a few weeks the matter of each dead larva dries down and lies spread on the lower side—not the bottom—of the cell, a brownish black scale of the thickness of a man's thumb nail. This peculiarity is of great use in making a diagnosis of the disease at some seasons of the year, as in the fall or in the spring, in the combs of a colony which has perished during the winter, as colonies affected with foul brood are very liable to do. Soon after the breeding season is over these scales are about the only evidence of the disease that remains in a strong colony, as the cappings of the diseased cells are apt to be cleared away, but in a weak colony the discolored defective cappings

largely remain. It seems to be beyond the power of the bees to remove these scales, so if foul brood has been present they remain to reveal it if one will take the proper course to discover them. This is best done in this way: Take the comb by the top bar and hold it so that a good light falls into the cells at an angle of about 70 or 80 degrees from the top of the comb, while the sight falls upon the cells at an angle of about 45 degrees. The scales if present will be readily discovered lying as already described, reaching almost to the margin of the lower side of the cell. I consider this a very sure method of diagnosis, though in one or two cases I have seen similar scales where the death of the brood resulted from other causes.

Other characteristics of the disease which are useful in aiding in its discovery are the peculiar odor and the appearance of the cappings of diseased cells; such cappings, while they vary in color, are generally darker than those of healthy cells, almost always sunken or flattened, often have irregular perforations of varying sizes and the comb containing much of the disease presents altogether an unprosperous, sickly appearance. The odor is very unpleasant and may be described as an "old smell," and it is well said to be like that of a poor quality of glue when heated. If a colony is badly diseased the odor is sometimes felt on raising the cover of the hive and generally on applying the nose to the top of the brood combs.

If one handles the combs of his bees frequently and keeps the subject of foul brood on his mind, what I have already said will enable him to discover the disease very soon after its appearance in his apiary, but if brood combs are handled but little it is quite important, if one would insure himself in some degree against losses from the disease, that a strict watch be kept on the condition, in respect to disease, of all colonies that appear from external indications to be lacking in prosperity, and especially of colonies to which robbers seem to be attracted, for the odor of foul brood has an attraction to bees, seeming to indicate to them that the colony emitting it is about in a condition to permit its being robbed with impunity. And this not because colonies wanting in prosperity are more likely to contract the disease, but because this condition may be the result of disease. If the disease is once discovered to be present, then it would be the part of wisdom to examine each colony carefully under strict regulation against robbing.

The cure of floul brood is difficult only because it is difficult to discover the disease in its incipient stages in every colony, and to determine every colony in which are germs of disease lying dormant ready to develope when favorable conditions are present, it may be after many months. And when the disease is disseminated among the bees in the neighborhood, especially among wild bees, a final cure may be the work of years, but with care, even under the worst circumstances, it may be kept in such subjection that the injury therefrom will not be great, and under favorable circumstances it may be quickly exterminated.

The cure of any particular colony is very simple and certain, the cautions to be observed having to do with preventing the access of bees from healthy colonies to the diseased combs, since such access would almost certainly spread the disease to other colonies. To preclude this danger, all the necessary operations must be performed when no bees are flying, or when the pasturage offers so much nectar that there is no dis-

position to rob. These conditions being secured, take a hive externally as nearly like the one containing the diseased colony as possible, and having moved the hive with the colony to one side, place the new hive furnished with foundation or starters on the old stand, then run the bees into the new hive by shaking or driving. This is all that is necessary for the cure of the colony if nectar is coming in somewhat freely. If nectar is scarce or absent, absconding must be guarded against and feeding resorted to. Without being certain that it is necessary, I advise feeding scantily for four or five days, and after that as plentifully as desired. From this it will be seen that it is preferable to attend to the cure during a honey flow.

The plan insisted on by some, that the colony be shaken out into still another hive after being allowed to build comb for four days, I have proved in a hundred cases without a single failure to be entirely unnecessary.

I wish here to put in a word of caution against the placing of any reliance upon drugs for curing this disease. My earliest experience was with thirty diseased colonies, upon which I tried the use of drugs thoroughly. I repeated their use upon other colonies later, sometimes with extreme care, but with entire failure in every case.

Sometimes when the disease is discovered in its early stages there is large amount of healthy brood in colonies that are to be treated, and its disposal is a problem that deserves consideration. Sometimes such colonies cast swarms in the swarming season. In such case I hive the swarm on foundation or on frames with starters, always avoiding combs for that purpose. Then in three weeks I shake out the bees from the old hive according to the directions already given. Other colonies that are fit to swarm during the swarming season but are not disposed to do so I compel to swarm, i. e., I shake out a swarm and then I treat both old hives and swarms as in case the swarms were natural ones. With weaker colonies and at other seasons this course is not always practical. Under such circumstances, if there are several colonies it is sometimes convenient to shake out all but one or two and give all the brood to that one or two, which are to be treated three weeks later. If there is but one colony it may sometimes be desirable to cage the queen for three weeks—but not often—it is generally better to sacrifice the brood and give the colony a new start.

If colonies have become greatly reduced in strength by the disease, as the bees are mostly aged under such circumstances, it is advisable either to unite or destroy them, but in doing this extreme care is necessary to prevent the escape of any of the bees into hives containing healthy colonies.

I have already intimated that the chief difficulty in effecting a final cure is the existence of the disease among neighboring bees, especially among wild bees. The reason of this is that the spread of the disease is owing principally if not wholly to the visiting of diseased combs by bees from healthy colonies—or in other words, by the robbing of diseased colonies, and if there is any other way of contracting the disease it is because there are other ways by which the germs of foul brood may get into hives of healthy bees. If one considers that diseased colonies in the woods or belonging to careless neighbors are sure in time to fall a prey to healthy colonies, the serious nature of the difficulty is readily appre-

ciated. This consideration also indicates the extreme care that should be used to prevent robbing in a locality where the disease is known to exist, as well as the care that must be given to secure from bees the combs and honey taken from diseased colonies. Their immediate and complete destruction by fire would be the safest course for many to pursue, but the honey and wax are sometimes of considerable value, and this extreme course need not be pursued if one is careful and has proper conveniences for disposing of the honey and comb. When there is but little honey in the combs, it is best to boil the combs at once and secure the wax. If there is honey which it is desired to save, first cut out all parts of the comb containing brood and boil or burn them, then extract the honey, which may be used for the table or boiled with one or two parts of water and used as food for the bees. Boil at least fifteen minutes. The comb must then be boiled and the wax secured. Or if the honey is only desired to feed the bees, the combs, honey and all, may be boiled in just the amount of water necessary and the bee food and wax secured at the same time and with less labor and trouble. It is to be borne in mind that all honey from these combs is dangerous for bees unless it is thoroughly boiled.

Not a few, I fear, will exclaim at my intimation a little ago that foul brood could only come from foul brood germs, and begin to assert that it can come equally well from brood that has been chilled to death. In Virgil's time, swarms of bees were bred from the carcass of an ox; when good Izaak Walton lived, the fish called the pike bred from pike weed; lately chess grew from wheat, and now foul brood grows from something else.

Well, bees, and fish, and chess, have now come to increase normally, and if foul brood has not yet, it very soon will.

No, it is still true that men do not gather grapes of thorns nor figs of thistles.

B. L. TAYLOR.

Lapeer, Mich., Nov. 17, 1897.

SUPPLEMENTARY REPORT OF THE APIARIST FOR THE SUMMER OF 1897.

The bees belonging to the Station were received at the College, May 19, 1897. After due examination, they were united into twelve colonies. Many of the queens were old and were replaced by tested Italians. Several methods of introducing queens were tried, but the one giving the most satisfaction, all things considered, was by the use of a frame four inches square by one-half inch high, covered with wire cloth upon one side. After putting the queen on the comb where the young bees were hatching, the frame was put over her and fastened down by a wire which was put over the top, pushed through the comb on both sides of the cage and fastened on the opposite side of the comb. The queen is left under this cage for about thirty-six hours and then tentatively released. If the bees indicate their refusal to receive her by "balling her," she is returned to the cage for another day.

Among the improvements may be mentioned the replacing, as far as necessary, of old hives of early model by new ones with improved Hoffman frames. In the bee yard each hive stands on a mound of sand three inches high with a minature dooryard of clean sand in front. A serviceable honey house has been found by remodeling a small barn.

Most of the experiments planned in this division of the Station work will require more than one season for their completion. Among the matters studied, I may mention the following:

Bee Paralysis.—This disease has spread but little in this State, but owing to its increase in the south it was thought advisable to investigate the liability of contagion. Two queens were purchased of T. S. Ford of Mississippi. They were taken from colonies badly infected with the disease, and on arrival at the College were introduced to healthy stock. These hives were removed from the bee yard a distance of a half a mile. The queens were introduced in June; on October 29, the first traces of what might have been a mild form of the disease appeared. Four or five bees were found at the entrance having the shiney, bloated appearance said to characterize those that die of the paralysis. The other colony has never shown the slightest trace of the disease, and remained strong and apparently healthy. This trial was insufficient to demonstrate a liability of contagion among Michigan bees from queens introduced from the south.

Foundation Tests.—Three colonies, designated as Nos. 1, 2, and 3, were used in this experiment. Owing to the absence of strong colonies during the honey flow, the experiment was made by feeding back, towards the latter part of August.

The super placed on No. 1 was filled with alternate sections of drawn and thin foundation. This colony was fed all they would take until the super was filled. The super on No. 2 was filled on one side with drawn and the other with thin foundation. This colony was fed three pounds per day. The super on No. 3 was filled with a row of sections fitted with drawn and a row of sections fitted with thin foundation, alternately

through the super and without separators between. This colony was fed less than a pound a day.

These supers were examined every day and progress noted. At first the bees began on the drawn and scarcely touched the thin. Later on these conditions were reversed, and the bees showed a marked preference for the thin. In Nos. 2 and 3 the supers were removed before they were entirely filled, and in these the drawn was ahead. Had No. 3 been fed as heavily as No. 1, it probably would have shown a preference for the drawn. In each super there were twelve sections of drawn and twelve of thin. The results of the test are tabulated below:

Super.	Thin.			Drawn.		
	Beginning. Pounds.	End. Pounds.	Gain. Pounds.	Beginning. Pounds.	End. Pounds.	Gain. Pounds.
No. 1	.81	10.20	9.39	.88	10.10	9.12
No. 2	.81	9.20	8.39	.88	9.70	8.82
No. 3	.80	5.30	4.50	.88	5.65	4.77

Per cent of honey in the thin foundation.......... 96.46
Per cent of honey in the drawn foundation.......... 95.51
Per cent of wax in the thin foundation.............. 3.54
Per cent of wax in the drawn foundation............ 4.49

A great many queens were bred for the purpose of testing the question whether a strain of bees could be produced which should be characterized by long tongues. The tongues of several bees of each colony were measured and were found to average as follows: Black, 4.2 m. m.; Hybrid, 4.9 m. m.; Italian, 5.2 m. m. One colony of Italians had tongues measuring 5.3 m. m. The drones from this hive were allowed to fly at will and all the others kept down. As a result, we have one queen the tongues of whose progeny measure 5.41 m. m. This result is very encouraging and leads us to continue the experiment.

Respectfully submitted,

JOHN M. RANKIN,

Apiarist.

REPORT OF CHEMICAL DEPARTMENT OF THE EXPERIMENT STATION.

Prof. C. D. Smith, Director of Experiment Station:

I herewith submit the annual report of the Chemical Department of the Experiment Station for the year ending June 30, 1897.

WORK IN THE CHEMICAL LABORATORY.

A large number of chemical analysis have been made during the year, the most important of which may be placed in the following classes:

I. COMMERCIAL FERTILIZERS.

So important to the farmer and fruitgrower is the composition of the fertilizers he buys, as determining their money value as well as the manural value, that large attention has been given to this subject. During the year eighty samples of commercial fertilizers have been collected and analyzed, and the results of such analyses have been given to the public in Bulletin 145 for all the fertilizers licensed for sale in this State. So large has been the demand for this bulletin that the edition is nearly exhausted, yet requests from farmers for "the fertilizer book" come almost daily to this office.

II. ANALYSES FOR THE FARM DEPARTMENT.

The co-operation of the Farm and the Chemical Departments brings them into close relation in the work of the Station. As an illustration, the following list of analyses made for the Farm Department is given:

Samples of butter	5
Grains	3
Fodders and feeding stuffs	65
Ashes	1
Sugar beets	2
Soil waters (drainage)	6

III. MISCELLANEOUS ANALYSIS AND INVESTIGATIONS.

The foregoing list falls far short of covering the work of this Department. In addition, analyses have been made of samples of salt, of iron and steel, of sugar, of milk, of manure, of soil, etc. It is a matter of weekly occurrence to receive minerals for indentification or analysis. A man finds a rock full of yellow specks that glitter like gold, and he is anxious to know whether he has a gold mine, and is disappointed to find it is only mica. Another discovers beautiful yellow crystals and is sure it is gold, and his hopes vanish when he learns it is only iron pyrites,

a material so often mistaken for the precious metal that it has been named "fool's gold." If the chemist has not developed a bonanza in such cases, he has at least saved the parties from a useless expense and greater disappointment. A farmer finds a whitish deposit at the bottom of a muck bed and sends it to the Station, and then learns about marl and its uses.

Samples of another kind often come to the chemist. A party sent the stomach of an animal for analysis to determine what poison had been given, assigning no reason for such request. A woman sent a vial of medicine to be analyzed at once, "because it affected her so queerly and she was sure the druggist had made a mistake, and he would have to pay for it dearly." In these cases the chemist probably lost an opportunity to figure as witness in court at a dollar per day, while paying two dollars daily for hotel bill.

A State institution wants analysis of the kinds of soils on their farm to find what fertilizers they had better buy. A good friend sends several kinds of marl and clay for analysis to determine their value for making Portland cement. Each of these analyses would take the entire time of a chemist for at least one week and would be of no value to the public, but only to the parties concerned.

THE AGRICULTURAL CHEMIST AND THE PUBLIC.

Perhaps there is a misconception as to the duties of the College chemist. His first and most important duty is to teach the classes in chemistry and carry on the work of the College in this line. In the second place, as Chemist of the Experiment Station, it is his duty to carry out such investigations of a chemical nature as will aid the other departments of the Station; and thirdly, to carry on such work of a chemical nature as will be of benefit to the public. Manifestly it is not his business, at the neglect of the three classes of duties just enumerated, to take up work of a miscellaneous kind, for any one who may apply, which will be of no benefit or interest to the public and will be valuable only to the individual concerned. Work should be carried on which will be of most value to the greatest number.

ANALYSIS OF MICHIGAN SOILS.

Nearly twenty years ago the Chemist tried to make a collection of soils that would be fairly representative of the soils of different counties in the State, to make analysis of such soils and publish the results as a kind of chemical soil-map of the State. The plan was only imperfectly carried out, many counties failing to furnish samples for this purpose. The results, such as they were, were published in the report of the State Board of Agriculture for 1878.

As a contribution to the Agricultural section of the College exhibit to the Quadricentennnial Exposition in Chicago in 1893, this department gathered additional samples of soil, analyzed them, and presented the results of 38 samples of soil in Bulletin 99, which was widely distributed in Chicago.

It is thus shown that the College has taken a lively interest in the composition of Michigan soils.

The analysis of a soil, to be of much practical value, requires great care in the selection of the soil—a process confessedly demanding experience and good judgment. The thoughtless and haphazzard selection of a soil will probably vitiate the results of the most careful analytical work. Few people realize the amount of time and work required for such analysis. A gentleman in Lansing, who called himself a judge of such work, declared that a chemist who knew his business could analyze a soil in five minutes and thus tell how many bushels of wheat per acre such soil would produce. On the contrary, it often takes many hours and sometimes days to bring the soil into solution as the first step in analysis.

So many things are involved in a practical soil analysis to secure such results as will be of general and permanent value, and so large demand is made upon the time of the Chemist, that the Experiment Station council, after considering the whole subject, decided by unanimous vote that analysis of soil should be made only by direction of the Station council, and that when such analysis is to be made the sample should be selected by the Chemist or under his direction.

WHEAT AND FLOUR.

Many investigations on the relative value of different wheats and their products have been carried forward, primarily for the benefit of millers, but secondarily for the profit of farmers. These are still in progress.

METEOROLOGICAL OBSERVATIONS.

Complete meteorological observations, taken three times a day, have been taken during the year and the results submitted for publication. The series of such observations has been continued for thirty-three years —the most complete set ever made in this State. The value of such work as related to the climate of our State, and the conditions for general crops and such special crops as sugar beets, becomes manifest.

Respectfully submitted,

R. C. KEDZIE,

Chemist Experiment Station.

June, 1897.

SUMMARY OF METEOROLOGICAL OBSERVATIONS AT THE MICHIGAN AGRICULTURAL EXPERIMENT STATION FOR THE YEAR 1896.

IN CONTINUATION OF THE SAME SERIES OF OBSERVATIONS RECORDED FOR THE MICHIGAN AGRICULTURAL COLLEGE SINCE 1863.

BY R. C. KEDZIE, PROFESSOR OF CHEMISTRY AND CHEMIST OF THE STATION.

	Mean monthly temperature in the open air.	Barometer corrected for temperature.	Percentage of cloudiness.	Mean monthly maximum temperature.	Mean monthly minimum temperature.	Rain and melted snow, inches.	Snow, inches.	Thunder storms.
January	24°.65	29.117	76	30°.00	15°.20	.79	3¾	------
February	24 .28	28.916	67	31 .48	12 .93	1.51	11½	------
March	28 .70	29.052	52	36 .81	18 .10	1.31	5¾	1
April	52 .64	29.067	46	62 .93	40 .20	2.77	½	5
May	66 .48	29.035	41	77 .27	50 .97	3.14	--------	5
June	69 .87	29.060	44	81 .73	53 .77	2.60	--------	5
July	71 .83	29.070	58	82 .06	57 .64	6.73	--------	2
August	69 .99	29.087	45	82 .16	54 .77	4.73	--------	9
September	57 .62	29.064	60	67 .50	43 .00	6.73	--------	2
October	44 .61	29.090	42	55 .81	29 .19	1.06	--------	------
November	37 .09	29.112	71	44 .23	27 .53	1.05	4.0	------
December	28 .13	29.047	74	34 .26	19 .61	.80	11.0	------
Means	47 .99	29.057	56	57 .10	35 .25	------	------	------
Sums	---------	---------	---------	---------	---------	35.20	35¾	29

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	13	22	25	20	100	100	100	.078	.118	.135	28.951	28.941	28.884	28.925
2	33	35	20	29⅓	89	100	85	.175	.204	.091	28.702	28.628	28.937	28.756
3	12	11	3	8⅔	100	100	100	.075	.071	.050	28.990	29.090	29.325	29.135
4	−6	9	−1	⅔	100	100	70	.033	.065	.032	29.363	29.389	29.413	29.388
5	−11	9	6	1⅓	100	100	100	.027	.065	.057	29.357	29.340	29.431	29.376
6	8	18	17	14⅓	100	100	100	.062	.098	.094	29.194	29.067	29.164	29.142
7	18	25	12	18⅓	100	100	100	.098	.135	.075	29.030	29.096	29.311	29.146
8	14	28	28	23⅓	100	100	100	.082	.153	.153	29.126	28.859	28.921	28.969
9	30	33	32	31⅔	100	100	89	.167	.188	.162	28.869	28.923	29.125	28.972
10	30	34	31	31⅔	100	100	100	.167	.196	.174	29.049	29.058	29.176	29.094
11	29	33	36	32⅔	100	100	90	.160	.188	.191	29.023	28.877	28.822	28.909
12	21	19	16	18⅔	100	100	100	.113	.103	.090	28.791	29.019	29.093	28.968
13	14	20	19	17⅔	100	100	100	.082	.108	.103	29.056	29.035	29.218	29.103
14	20	24	16	20	100	100	65	.108	.120	.059	29.289	29.350	29.547	29.395
15	−1	25	19	14⅓	100	74	69	.042	.100	.071	29.494	29.445	29.282	29.407
16	17	33	29	26⅓	100	80	89	.094	.150	.148	29.168	29.146	29.286	29.200
17	29	36	33	32⅔	100	71	89	.160	.149	.168	29.258	29.109	29.178	29.182
18	32	36	33	33⅔	89	90	100	.168	.191	.188	29.013	29.009	29.000	29.007
19	25	27	27	26⅓	100	100	100	.135	.147	.147	29.056	29.189	29.219	29.155
20	26	34	28	29⅓	100	69	100	.141	.175	.153	29.032	28.983	29.189	29.068
21	28	29	26	27⅔	100	100	75	.153	.160	.105	29.140	29.152	29.258	29.182
22	19	25	24	22⅔	100	100	86	.103	.135	.111	29.128	29.080	29.149	29.119
23	32	35	34	33⅔	89	90	89	.162	.183	.175	28.888	28.775	28.881	28.848
24	34	36	33	34⅓	100	100	80	.196	.212	.150	28.638	28.611	28.977	28.742
25	33	32	31	32	100	89	100	.188	.162	.174	28.944	28.993	29.217	29.051
26	26	27	20	24⅓	87	100	100	.123	.147	.108	29.254	29.384	29.407	29.348
27	18	32	24	24⅔	100	100	100	.093	.181	.129	29.294	29.246	29.326	29.289
28	26	32	28	28⅔	100	100	100	.141	.181	.153	29.239	29.181	29.248	29.223
29	25	42	37	34⅔	100	100	90	.135	.267	.199	29.095	29.098	29.278	29.157
30	33	37	34	34⅔	100	100	89	.188	.221	.175	29.250	29.243	29.377	29.291
31	33	37	38	36	100	100	91	.188	.221	.208	29.158	29.047	29.003	29.069
Sums														
Means				24.65	99	96	92	.124	.155	.130				29.117
Average						96			.136					

JANUARY, 1896, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
100	Cu.	40	Str.	100	Cu.	s w		s w	10	s w	11	34	13	*	10 a. m.		
100	Cu.	100	Cu.	100	Cu.	s w	10	s w	14	w	9	34	11	†2:30pm	7 p. m.		¼
100	Cu.	50	Cir.			w	9	w	14	w	8	14	−8				
		50	Cu.			w	3	s w	11	s w	6	10	−17				
		10	Cir.	100	Nim.	s w	1	s w	2	s e	13	10	−9	In night		.02	¼
100	Nim.	100	Cu.			s e	11	s e	13	s e	8	19	8				
100	Cu.	60	Cir.				0	n e	5		0	26	4				
20	Cir.St.	60	Cu.	100	Cu.	s	2	s	9	s	9	31	15				
100	Cu.	100	Cu.	100	Cu.	n w	5	n w	5		0	34	27	‡Mist			
100	Cu.	100	Cu.	100	Cu.		0		5	s	8	33	27				
100	Cu.	100	Cu	100	Cu.	s w	5	s	10	s	14	34	19				
80	Cu Ci.	80	Cu.	100	Cu.	s w	17	w	16	s w	8	23	13	*			
100	Cu.	100	Nim.	100	Nim.	s w	3	s w	4	s w	5	21	13	†9 a. m.	Morn.	1	¼
100	Cu.	100	Cu.	100	Cu.	w	4	s w	8	s w	2	26	−6		Night	.03	1½
10	St	50	Cir.				0	s e	5	s w	8	24	−5				
70	Cu St.					s w	4	s w	5		0	34	14				
100	Cu	100	Cu.	100			0	s	2	s	3	36	29				
100	Nim.	100	Nim.	100	Cu.	s	6	s w	5	w	1	37	24	§8 a. m.	Night	.12	
100	Cu	100	Cu	100	Cu.	n w	7	n w	4		0	29	23				
100	Nim.	100	Cu.			s	9	s w	8	s w	5	35	24	†7:30am	9 a. m.		
100	Cu.	100	Cu.	100	Cu.	n e	1	e	3	e	3	30	19				
100	Cu.	100	Cu.	100	Cu.	n e		e		e		33	18	‡Morn.	12 m.	.29	
100	Nim.	100	Nim.	100	Cu.	n e	3	n e	7		0	36	30	§Morn.	Night	.33	¼
100	Nim.	100	Nim.	100	Cu.	n	5	n e	4	n e	3	37	31				
100	Cu.	100	Cu.	100	Cu.	s w	3	w	7	w	6	37	24				
100	Cu.	100	Cu.	30	Cir.	n w	7	n w	6	w	1	30	14				
70	Cu Cir.			30	Cir.	s w	1	s w	5		0	32	17				
100	Cu.	100	Cu			s w	5	s w	9	s w	10	33	18				
		20	Cir.	60	Cir.	s w	5	s w	8	s w	7	39	24				
100	Cu.	100	Cu.	100	Cu.		0	n e	3	n e	4	38	25				
100	Cu.	100	Cu.	100	Cu.	s e	7	e	6	n e	4	41	32	‡9:30am			
																.79	3¼
82		78		68								30.00	15 20				
76																	

* Snow flurries. † Snow. ‡ Rain. § Rain and snow.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	38	36	32	35⅓	100	100	89	.229	.212	.162	28.803	28.914	29.025	28.914
2	31	33	30	31⅓	89	89	89	.155	.168	.148	28.970	28.955	28.893	28.939
3	28	32	25	28⅓	100	89	100	.153	.162	.135	28.620	28.573	28.701	28.631
4	24	30	28	27⅓	100	100	100	.129	.167	.153	28.586	28.618	28.772	28.657
5	18	38	25	27	100	100	100	.098	.229	.135	28.705	28.651	28.756	28.704
6	28	33	26	29	100	100	100	.153	.188	.141	28.532	28.503	28.613	28.549
7	26	33	26	28⅓	100	100	100	.141	.188	.141	28.713	28.766	29.030	28.836
8	26	32	26	28	100	100	100	.141	.181	.141	28.966	28.897	28.955	28.939
9	26	28	26	26⅔	100	100	100	.141	.153	.141	28.800	28.811	28.862	28.824
10	26	35	26	29	100	100	100	.141	.204	.141	28.752	28.488	28.736	28.659
11	18	24	5	15⅔	100	100	100	.098	.129	.055	28.859	28.968	29.285	29.037
12	8	20	12	13⅓	100	100	100	.062	.108	.075	29.210	29.125	29.108	29.151
13	21	28	21	23⅓	85	100	85	.096	.153	.096	28.775	28.847	29.104	28.909
14	20	28	20	22⅔	100	100	85	.108	.153	.091	29.107	29.097	29.119	29.108
15	40	38	12	30	91	100	100	.225	.229	.075	28.814	28.786	29.250	28.950
16	−1	8	−3	1⅓	100	100	100	.042	.062	.038	29.311	29.379	29.365	29.352
17	−14	12	7	1⅔	100	100	76	.024	.075	.015	29.481	29.325	29.294	29.367
18	20	26	24	23⅓	100	100	100	.108	.141	.129	28.797	28.676	28.691	28.721
19	9	13	3	8⅓	100	100	100	.065	.078	.050	28.437	28.535	28.851	28.608
20	−6	10	1	1⅔	65	100	100	.024	.068	.046	28.980	29.093	29.277	29.117
21	8	20	4	10⅔	100	100	100	.062	.108	.052	29.361	29.339	29.342	29.347
22	6	36	37	26⅓	100	100	81	.057	.212	.178	29.194	29.135	29.081	29.137
23	37	41	34	37⅓	81	91	79	.178	.235	.155	28.881	28.928	29.017	28.942
24	33	37	20	30	89	81	85	.168	.178	.091	29.017	29.055	29.264	29.112
25	10	34	32	25⅓	100	100	100	.068	.196	.181	29.245	29.112	28.901	29.086
26	32	42	37	37	100	83	81	.181	.222	.178	28.685	28.740	28.775	28.733
27	37	52	42	43⅔	90	87	91	.199	.362	.244	28.519	28.469	28.623	28.537
28	37	45	31	37⅔	100	84	89	.221	.251	.155	28.614	28.751	28.886	28.750
29	23	27	23	24⅓	86	100	100	.106	.147	.123	28.931	28.941	28.933	28.935
Sums	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Means	------	------	------	24.28	96	97	94	.123	.171	.120	------	------	------	28.916
Average	------	------	------	------		96			.138		------	------	------	------

FEBRUARY, 1896, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
100	Nim.	100	Nim.	70	Cir.	w	8	s w		n w		39	24	*con'ng	Night	.11	
80	Cir.	100	Cu.	100	Cu.	n e		s e	7	n e	6	36	25				
100	Nim.	100	Nim.	100	Nim.	n e	4	n e	4	n e	3	32	23	†Morn.			
100	Nim.	100	Nim.	100	Nim.	n e	1	w	4	s w	5	32	14	Snow			
90	Cu.	90	Cu.	100	Cu.	s w	3	s w	7	s w	1	40	15	Snow	Night	.39	5
100	Cu.	40	Cir.			n e	4	s w	6	s w	7	38	24				
100	Nim.	100	Nim.	100	Nim.	s w	8	s w	10	s w	4	33	28	Snow			
100	Cu.	100	Cu.	100	Cu.	s w	6	s w	4	n e	2	36	24	Snow		.09	¼
100	Cu.	100	Cu.	100	Cu.	s w	2	s w	8	s w	6	32	23				
50	Cir.	100	Cu.	100	Cu.	s w		s w		s w		35	17	Snow			
100	Cu.	60	Cu.			s w		s w	18	s w	2	23	0			.08	
100	Cu.	100	Nim.	100	Nim.	s e	1	n e	4	n e	4	19	6	†1 p. m			
100	Nim.	100	Nim.			n e	3	s w	5	s w	4	28	14	Snow	Night	.56	5½
90	Cir.Cu.	5	Cir.	100	Cu.	w	6	s w	11	s w	8	40	18			.08	
90	Cu.	100	Cu.	100	Cu.	s w	14	w	7	n w	5	40	—12				
100	Cu.						0	n	5		0	10	—22				
							0	s w	9	s e	9	12	—8				
100	Nim.	100	Nim.			s w	11	s w	15	s w	11	27	8	†Morn.	Night	.11	1
70	Cir.	100	Nim.	30	Cir.	s w	12	n w	14	w	10	14	—10	†Morn.	Night	.04	½
		80	Cu.			n w	3	s w	8	s w	3	11	—4			.02	
100	Cu.	100	Cu.			s w	1	s w	12	s w	6	19	3				
		40	Cir.			s w	9	s w	13	s w	12	36	11				
100	Nim.	70	Cu.			s w	15	s w	18	s w	7	39	27	*Night		.04	
70	Cu.	100	Cu.	90	Cu.	n w	1	n w	3	n w	9	37	7				
10	Cir.	100	Cu.	100	Nim.		0	s w	9	s w	13	34	18	†8 p. m.	9 p. m.	.04	¼
		20	Cu.	50	Cir.	s w	2	s w	4	s e	3	41	31				
		50	Cir.	70	Cir.	s	11	s w	11	s w	5	54	31				
95	Cu.	80	Cu.			w	4	s w	6	n e	2	45	20				
80	Cu.	85	Cu.	30	Cir.	n e	6	n e	6	n e	9	31	20				
																1.51	11½
72		77		58								31.48	12.98				
		67															

* Rain. † Snow.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	21	31	24	25⅓	100	100	86	.113	.174	.111	28.791	28.931	28.998	28.907
2	20	31	24	25	100	100	100	.108	.174	.129	29.108	29.187	29.383	29.226
3	18	24	24	22	100	100	100	.098	.129	.129	29.443	29.405	29.459	29.436
4	15	32	22	23	100	100	100	.086	.181	.118	29.500	29.322	29.350	29.391
5	20	35	32	29	100	100	100	.108	.204	.181	29.263	29.154	29.102	29.173
6	34	43	34	37	100	100	79	.193	.278	.155	28.784	28.764	28.839	28.796
7	28	30	30	29⅓	88	89	100	.135	.148	.167	28.776	28.871	29.082	28.910
8	24	34	25	27⅔	100	79	100	.129	.155	.185	29.062	28.839	29.199	29.033
9	24	42	29	31⅔	100	100	100	.129	.267	.160	29.084	28.987	28.988	29.020
10	28	30	21	26⅓	100	100	85	.153	.167	.096	28.902	28.807	28.947	28.885
11	17	22	9	16	100	100	100	.094	.118	.065	28.717	28.697	28.889	28.768
12	2	16	4	7⅓	100	83	100	.048	.074	.052	28.857	28.997	29.168	29.007
13	5	23	8	12	100	100	100	.055	.123	.062	29.236	29.286	29.478	29.333
14	14	27	23	21⅓	100	100	86	.082	.147	.106	29.486	29.502	29.418	29.469
15	26	31	26	27⅔	100	100	87	.141	.174	.123	29.190	29.083	29.034	29.102
16	21	32	25	26	100	100	74	.113	.181	.100	28.976	28.955	29.140	29.024
17	22	37	26	28⅓	100	81	87	.118	.178	.123	29.074	29.077	29.189	29.113
18	30	39	30	33	100	100	100	.167	.238	.167	29.118	29.022	28.956	29.032
19	31	34	21	28⅔	100	89	85	.174	.175	.096	28.683	28.682	29.018	28.794
20	14	28	23	21⅔	100	100	100	.082	.153	.123	29.062	29.066	29.178	29.102
21	32	42	41	38⅓	89	83	91	.162	.222	.235	28.877	28.818	28.805	28.833
22	18	27	23	22⅔	100	100	100	.098	.147	.123	29.276	29.413	29.472	29.387
23	21	32	22	25	100	100	100	.113	.181	.118	29.420	29.411	29.559	29.467
24	22	37	31	30	100	81	100	.118	.178	.174	29.442	29.298	29.156	29.299
25	36	52	46	44⅔	80	79	92	.170	.306	.286	28.808	28.589	28.695	28.697
26	26	31	22	26⅓	87	100	100	.123	.174	.118	28.761	28.903	29.140	28.935
27	20	35	29	28	100	100	100	.108	.204	.160	29.114	29.037	29.137	29.103
28	32	46	46	41⅓	100	84	100	.181	.262	.311	28.881	28.692	28.603	28.725
29	52	57	37	48⅔	86	69	90	.334	.322	.199	28.518	28.557	28.786	28.620
30	37	52	36	41⅔	100	79	90	.221	.308	.191	28.856	28.935	29.204	28.998
31	34	58	42	44⅔	100	70	91	.196	.337	.244	29.091	28.999	29.060	29.050
Sums	......	......	......	......	......	......	......	......	......	......	....	....	....	....
Means	......	......	......	28.70	98	92	94	.134	.196	.147	....	....	....	29.032
Average	......	......	......	......		95			.159		....	....	....	....

MARCH, 1896, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction	Force.	Direction	Force.	Maximum.	Minimum.	Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
100	Cu.	100	Cu.	100	Cu.	n	3	n w	10	n w	12	31	19				
100	Cu.	20	Cu.			n w	12	n w	13	n w	7	82	18				
40	Cir.	80	Cu.			n e	4	n w	5	n w	2	28	12				
		80	Cu.	10	Cu.	n e	1	n e	4	n e	1	32	14				
60	Cir.	80	Cu.	100	Cu.	s e	2	s e	9	s e	16	35	17	*Night	8 a. m.	.34	
100	Nim.	100	Nim.	100	Cu.	s	4	s w	9	s w	6	42	25	†6 a. m.		.01	⅛
100	Nim.	100	Nim.	100	Cu.	s w	11	w	16	w	10	29	18				
80	Cu.	80	Cu.	100	Cu.	s w	4	s w	8	s w		28	12				
40	Cir.	100	Cu.	100	Nim.	s		s	3	s	1	35	20	6 p. m	Night	.20	2
100	Nim.	100	Nim.				0	n e	3	n e	4	25	13	†Night	Night	.03	1
95	Nim.	15	Cu.			n e	3	n e	8	n e	1	22	—1				
10	Cir.	20	Cu.			n w	5	n w	10	n w	1	19	—2				
10	Cir.	80	Cir.				0	s w	3		0	23	4				
		10	Cu.	15	Cu.	s w	2	s w	6		1	29	14				
80	Nim.	100	Nim.	100	Cir.	s e	1		6		0	30	15				
90	Cu.	80	Cu.				0	n w	3	s w	1	34	17				
50	Cir.	70	Cu.			s w	3	s w	13	s w	1	38	22				
100	Nim.	100	Cu.	100	Nim.	s w	1	s w	1		0	38	28	†8 a. m.	10 a. m.		
100	Nim.	100	Nim.	100	Cu.	n	1	n e	1		0	35	12	Cont.	‡	.15	2½
							0	n		s w		35	14				
50	Cir.	50	Cu.	100	Nim.	n w		w	18	w	15	48	19	*6 p. m	8 p. m.	.03	
5	Cu.	50	Cu.	30	Cir.	n e	7	n e	4		0	33	18				
100	Nim.	50	Cu.	50	Cu.	e	2	s w	3		0	32	17	§			
		40	Cu.	75	Cir.	s w	5	s w	15	s w	11	38	24				
50	Cir.	60	Cu.Cir.	100	Nim.	s w	16	s w	20	s w	11	58	25	*6 p. m.	Night		
100	Cu.	75	Cu.			n w	7	s w	12	s w	8	32	18				
						s e	2	s	7	s e	9	41	19				
100	Cu.	100	Cu.	100	Nim.	s e	13	s e	18	s e	17	58	35	*5 p. m.	Night	.55	
40	Cu.	10	Cir.			s w	19	s w	20	s w	4	59	28				
						w	3	s w	7		0	59	28				
				100	Cu.	n e	1	e	10	e	5	63	39				
																1.31	5⅛
58		56		48								36.81	18.10				
		52															

* Rain. † Snow. ‡ Forenoon. § Snow flurries.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	43	47	33	41	100	77	80	.278	.249	.150	28.740	28.772	28.916	28.809
2	20	24	19	21	85	86	100	.091	.111	.103	28.777	28.847	28.996	28.873
3	21	34	24	26⅓	100	79	86	.108	.155	.111	29.077	29.058	29.250	29.127
4	26	41	28	31⅔	100	74	88	.141	.190	.135	29.261	29.224	29.409	29.298
5	34	51	33	39⅓	74	72	80	.149	.270	.150	29.301	29.284	29.238	29.274
6	36	49	26	37	71	81	87	.149	.278	.123	29.216	29.198	29.323	29.246
7	26	41	32	33	100	82	89	.141	.212	.162	29.328	29.381	29.562	29.424
8	29	45	34	36	100	84	71	.160	.251	.138	29.485	29.395	29.337	29.406
9	35	41	38	38	100	100	81	.204	.257	.186	29.044	28.849	29.166	29.020
10	36	48	42	42	90	78	87	.191	.260	.228	29.151	29.096	29.154	29.134
11	47½	65	52	55	89	78	86	.291	.483	.334	29.096	29.011	29.197	29.101
12	56	81½	65	67⅔	87	62	78	.391	.664	.483	29.018	29.066	29.083	29.089
13	61	72	61	64⅔	66	66	91	.354	.5[illegible]4	.480	28.828	28.672	28.730	28.743
14	58½	69	44½	57⅓	85	85	92	.416	.599	.265	28.790	28.772	29.009	28.857
15	63	79	65	69	88	66	78	.510	.651	.483	28.935	28.881	28.998	28.938
16	55	84	66	68⅓	74	72	94	.321	.832	.604	28.939	28.964	29.131	29.011
17	72	82	66	73⅓	81	67	94	.631	.731	.604	28.9[illegible]8	28.890	29.231	29.036
18	72	80	63	71⅔	76	74	75	.595	.758	.509	28.928	28.999	29.110	29.012
19	66	61	56	61	95	83	100	.626	.442	.449	28.932	29.274	29.228	29.161
20	56	63	58	59	94	100	100	.420	.576	.483	29.026	28.864	28.975	28.955
21	56	60	41	52⅓	100	76	82	.449	.396	.212	28.855	28.856	29.114	28.942
22	41	61	44	48⅔	82	71	84	.212	.383	.241	29.235	29.0[illegible]2	29.222	29.180
23	49	60	50	53	83	88	85	.297	.456	.309	29.105	29.148	29.080	29.111
24	51	67	55	57⅔	100	89	87	.374	.591	.376	28.832	28.850	29.106	28.929
25	54	65	54	57⅔	80	78	87	.335	.483	.362	29.172	29.176	29.169	29.172
26	61	71	61	64⅓	77	66	66	.413	.503	.354	29.153	29.028	29.021	29.067
27	56	70	56	60⅔	100	80	100	.449	.586	.449	28.990	28.967	29.081	29.013
28	58	75	60	64⅓	100	81	88	.483	.705	.473	29.158	29.148	29.144	29.150
29	62	75	60	65⅔	88	81	85	.491	.705	.466	29.157	29.020	29.021	29.066
30	58	70	60	62⅔	94	80	91	.452	.586	.462	28.944	28.837	28.965	28.915
Sums														
Means				52 64	89	78	86	.337	.463	.329				29.067
Average						84			.376					

APRIL, 1896, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
100	Nim.	50	Cu.	90	Nim.	s e	12	s w	17	n w	19	47	18	*	†	.035	½
90	Cu.	100	Nim.	100	Nim.	w	14	s w	18	s w	8	32	17	‡8 a. m.			
100	Nim.	90	Cu.			n w		n w	16	n w	7	38	18				
						n w	7	n w	7	s e	3	46	19				
						s e	1	s w	10	s w	1	56	24				
20	Cu.	30	Cu.			n w	6	n w	11		0	48	25				
5	Cu. St.	40	Cu. St.			n e	7	n e	7		0	43	20				
5	Cir.	60	Cu.			s e	4	s e	10	s e	5	48	32	§ Morn.	4 p. m	.32	
100	Nim.	100	Nim.	100	Nim	s e	13	s	11	s e	11	43	36				
20	Cir.	50	Cir.	100	Nim.	s e	1	s w	7	s w	12	48	38	§3:30pm			
100	Cir.	50	Cir.			s w	5	s	2	s w	3	65	48	11 a. m.	5:30a m	.20	
		20	Cir.			s w	8	s w	14	s w	4	82	56				
100	Nim.	100	Cu.	100	Nim.	s w	9	s w	14	s w	25	71	62	§ Night	Night	.03	
50	Cu.	50	Cir.			s w	14	s w	14	s w	4	72	54				
		5	Cir.			s w	10	s w	16	s w	5	82	62				
20	Cir.	10	Cir	30	Cir.	s w	9	s w	13	s w	2	86	57				
20	Cir.	30	Cir.	30	Cu.	s w	3	s w	2	s w	1	82	54	8:30 p m	9 p. m.	.06	
20	Cir.	30	Cir. St.	30	Cir.	s w	5	s w	15	s w	7	80	53				
100	Cir.	90	Cu	5	Cir	s w	7	s w	9		0	62	36	7 a. m.	11 a m.	.05	
80	Cu.	100	Nim.	20	Cir.	s	6	s	16		0	66	53	‖	1 p. m.	.74	
100	Nim.	30	Cu. Cir.			w	2	n w	2	n w	1	61	25				
		5	Cir.			n e	9	s w	8	w	9	61	34				
100	Cir.	100	Cu.	100	Nim.	s e	5	e	7		0	61	43	§3:30pm	Night	.40	
100	Nim.	5	Cir.			s e	8	w	2		0	63	35				
20	Cir.			80	Cir.	n e	8	n w		n e		74	43				
70	Cir.	60	Cir.	100	Nim.	s e		s e	15	s e	14	72	50	§9 p. m.			
100	Nim.	100	Cu.	fog		s e	3	s w	4		0	74	46		9 a. m.	.325	
fog		80	Cir.	50	St.	n e	1	n e	5	n e	4	77	54				
50	Cir.	20	Cir.	100	Nim.	s e	11	s e	11	s e	11	77	51	§3:15pm	7 p. m.	.50	
100	Nim.	70	Cu.	50	Cir. St.	s e	9	s w	12	s w	2	71	43	3 p. m.	3:30 p m	.01	
																2.77	
52		49		36								62.93	40.20				
46																	

* Snow 9 p. m., rain 7 a. m.
† Night, rain 10 a. m.
‖ Rain 10:30 a. m.
‡ Snow.
§ Rain.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	63	77	67	69	88	82	84	.510	.758	.556	28.938	28.856	28.856	28.900
2	61	71	65	65⅔	94	80	100	.505	.608	.618	28.860	28.776	28.955	28.864
3	64	72	56	64	77	72	94	.464	.559	.420	29.070	29.071	29.061	29.067
4	65	76	64	68⅓	78	73	89	.483	.652	.529	29.049	28.933	29.033	29.005
5	59	72	56	62⅓	82	72	94	.410	.559	.420	29.101	29.068	29.127	29.104
6	63	76	59	66	77	68	82	.446	.614	.410	29.243	29.228	29.289	29.253
7	63	79	64	68⅔	83	73	77	.478	.704	.464	29.325	29.298	29.278	29.300
8	74	87	68	74⅔	77	65	84	.641	.836	.516	29.319	29.270	29.350	29.313
9	77	87	65	76⅓	78	69	94	.678	.882	.588	29.352	29.162	29.141	29.218
10	78⅓	86	65	76⅔	76	72	94	.738	.895	.583	29.152	29.110	29.074	29.112
11	71⅔	86	64	74	83	68	93	.638	.850	.563	29.068	28.950	28.997	29.008
12	70	82	65	72⅓	85	79	94	.621	.859	.583	28.978	28.975	29.025	28.993
13	64	76	64	68	89	91	83	.529	.812	.497	29.064	29.034	28.963	29.027
14	67⅓	76	56⅔	66⅔	87	81	97	.584	.781	.448	28.871	28.886	28.974	28.910
15	58	73	64	65	100	55	92	.403	.442	.586	29.128	29.196	29.245	29.190
16	65	73	64	67⅓	78	72	83	.451	.581	.497	29.218	29.130	28.939	29.096
17	64	73	66	67⅔	83	67	78	.497	.545	.470	28.794	28.848	28.946	28.863
18	62	75	64	67	88	77	94	.491	.666	.563	28.927	28.916	28.926	28.923
19	53	68	50	55⅓	93	83	96	.375	.478	.341	29.044	29.090	29.143	29.092
20	51	71	63	61⅔	86	58	83	.321	.492	.478	29.209	29.093	29.113	29.138
21	62	72	58	64	94	86	100	.523	.668	.483	29.072	29.001	29.017	29.030
22	63	76	60	66⅓	83	78	82	.478	.652	.426	29.129	29.161	29.211	29.167
23	57	73	56	62	87	81	94	.407	.655	.420	29.315	29.171	29.132	29.206
24	68	83	57	69⅓	75	72	87	.509	.802	.407	29.202	29.119	29.057	29.126
25	72	76	74	74	81	86	90	.631	.772	.758	28.833	28.695	28.729	28.752
26	66	74	64	68	84	73	89	.586	.604	.529	28.751	28.883	28.886	28.840
27	62	79	64	68⅓	90	69	89	.491	.691	.529	29.038	28.930	28.726	28.898
28	64	56	48	56	89	87	100	.529	.391	.335	28.698	28.680	28.960	28.779
29	55	66⅔	58	58⅔	87	61	87	.376	.400	.362	28.949	28.942	28.990	28.960
30	57	59	54	56⅔	87	97	87	.407	.476	.362	28.976	28.790	28.930	28.899
31	61	65	57	61	83	73	81	.442	.451	.378	28.999	29.013	29.117	29.043
Sums	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Means	......	......	......	60.48	84	75	89	.506	.648	.486	......	......	......	29.035
Average	......	......	......	......		83			.547		......	......	......	......

MAY, 1896, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
		50	Cu.	20	St.	s e	2	s	6	s	11	79	48		*		
100	Ni.	80	Cu.	50	Cu.	s w	7	s	9	s w	5	74	46	Rain Mo.	6:30 p m	.61	
		60	Cu.	30	Cu.	s w	5	s w	6	s w	1	78	54				
		80	Cu.	20	St.	s w	7	n w	8		0	78	46				
10	Cir.	50	Cir.Cu.				0	n e	2	n e	1	74	54				
70	Cu.					e	3	s e	5	s e	9	79	52				
80	Cir.	10	Cir.			s e	6	s w	7	s	4	80	52				
		5	Cir.			s w	4	s w	5		0	90	56				
		25	Cu.			s w	1	s w	8		1	89	59				
5	Cir.	10	Cu.			s	5	w	11		0	87	58				
5	Cu.	25	Cu.	50	Cu.	w	3	s w	7		1	88	60	†		Tr.	
5	Cu. St.	25	Cu.	50	Cu. St.	s w	2	s w	5		0	85	57				
70	Cu.	30	Cu.				0	s	10	s	4	85	57	‡		.06	
20	Cir.	25	Cu.	10	Cu.St.Cl.	s	12	s			0		48	5:30 p m	6 p. m.	.17	
		5	Cir.	0	0	s w	6	w				78	44				
100	Stra.	100	Stra.	95	Stra.	s e		s e	5	s e	12	71	59				
40	Cu.	0		0		s w	18	s w	28	w	9	74	62				
100	Nim.	90	Cu.	100	Nim.	s	5	w		w	3	76	52	§	7:30 a m	.4	
100	Cu.	85	Cu	0		n e	2	n e	2	n	2	68	43		In night	.21	
100	Cir. Cu.	0		95	Cu.	n e	3	s e	6	s e	6	74	42				
100	Stra.	100	Cu.	0		s	5	n w	8	w	2	79	53	‖			
75	Cir.	80	Cir.	0		n w	4	n w	6	n e	2	78	48				
10	Cir.	50	Cu.	10	Cu.	n e	3	e	3	s e		75	48				
10	Cu.	30	Cu.	90	Stra.	s e	4	s w		s w	2	85	65				
100	Cir. St.	100	Ni.	90	Nim.	s		s w	13	s w	10	81	56	In night	6 a. m.	.09	
20	Cir.	50	Cu.			s w	10	s w	17	s w	1	74	48	**	††	.06	
50	Cu.Cir.	80	Cu.	100	Nim.	s w	3	s w	18	s w	2	81	52	‡‡	§§	.81	
100	Nim.	100	Nim.	100	Nim.	s w	18	s w	13	s w	5	60	42	4 p. m.	7 p. m.	.07	
		50	Cu.	100	Nim.	s w	9	s w	11	s w	1	63	43	9 p m.	9:15 p m	.01	
60	Cu.	100	Nim.			s w	5	s w	1		0	67	38	11 a. m.	4 p. m.	.68	
		40	Cu.Cir.	20	Cir.	e	4	e	3	e	2	68	38				
																3.14	
43		48		33								77.27	50.97				
41																	

* Showers all day.
† Shower in night.
‡ In early morning.
§ In night of 17th; 8 p. m. of 18th.
‖ Light showers.
** 5 p. m., 10 p. m.
†† 6 p. m., night.
‡‡ 2:45 p. m., 6:30 p. m.
§§ 3:15 p. m., 11 p. m.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1.	57	67	50	58	81	75	93	.378	.489	.335	29.216	29.228	29.299	29.248
2.	61	73	59	64⅓	88	72	82	.473	.581	.410	29.309	29.232	29.230	29.257
3.	59	71	63	64⅓	100	80	88	.449	.608	.510	29.204	29.108	29.111	29.141
4.	64	81	72	72⅓	89	83	90	.529	.873	.706	29.111	29.056	29.055	29.074
5.	74	89	73	78⅔	90	73	100	.758	.997	.812	29.075	29.035	29.055	29.055
6.	74	90	72	78⅔	90	60	60	.758	.841	.841	29.065	28.982	29.045	29.030
7.	80	72	68	73⅓	87	90	95	.886	.706	.648	29.004	28.981	28.897	28.961
8.	67	77	62	68⅔	100	77	88	.662	.717	.491	28.810	28.692	28.745	28.749
9.	60	61	55	58⅔	100	68	100	.518	.473	.433	28.785	28.776	28.895	28.819
10.	64	68	49	60⅓	73	69	92	.433	.476	.322	28.979	29.008	29.039	29.009
11.	63	79	60	67⅓	72	74	88	.416	.731	.456	29.096	29.014	29.013	29.041
12.	70	78	60	69⅓	70	73	88	.516	.701	.456	28.890	28.730	28.855	28.825
13.	78	78	60	72	78	65	88	.744	.626	.456	28.849	28.915	28.988	28.917
14.	74	79	60	71	77	69	100	.641	.691	.518	29.086	29.062	29.155	29.101
15.	60	73	57	63⅓	100	72	100	.518	.581	.466	29.190	29.129	29.238	29.186
16.	63	75	57	65	83	77	100	.478	.666	.466	29.245	29.178	29.195	29.206
17.	64	79	64	69	78	74	83	.483	.731	.497	29.178	29.143	29.093	29.138
18.	72	81	64	72⅓	81	62	89	.631	.664	.529	29.172	29.063	29.118	29.118
19.	72	83	69	74⅔	81	79	95	.631	.891	.671	29.114	28.986	29.124	29.075
20.	79	88	69	78⅔	69	76	95	.691	1.010	.671	29.082	29.034	29.012	29.043
21.	74	86	76	78⅔	90	84	95	.758	1.038	.854	28.992	28.981	28.982	28.985
22.	74	80	64	72⅔	90	74	89	.758	.758	.529	29.073	29.060	29.095	29.076
23.	66	78	59	67⅔	78	73	88	.502	.704	.439	29.118	29.062	29 078	29.086
24	64	75	66	68⅓	89	86	94	.529	.745	.604	29.048	29.035	29.079	29.054
25.	69	87	71	75⅔	95	80	90	.671	1.024	.682	29.122	29.048	29.133	29.101
26.	66	77	68	70⅓	84	77	90	.536	.717	.612	29.292	29.234	29.242	29.256
27.	74	79	69	74	77	74	85	.641	.731	.599	29.168	29.026	28.889	29.028
28	66	77	63	68⅔	84	73	88	.536	.678	.510	28.811	28.852	29.007	28.890
29	67	76	67	70	75	73	79	.489	.652	.522	29.007	29.090	29.209	29.102
30.	65	83	62	70	84	72	88	.516	.802	.491	29.273	29.196	29.240	29.236
Sums	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Means	------	------	------	69.87	84	75	90	.584	.730	.551	--------	--------	--------	29.060
Average	------	------	------	------		83			.622		--------	--------	--------	--------

JUNE, 1896, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds. 7 A. M. Per cent of cloud.	Clouds. 7 A. M. Kind.	Clouds. 2 P. M. Per cent of cloud.	Clouds. 2 P. M. Kind.	Clouds. 9 P. M. Per cent of cloud.	Clouds. 9 P. M. Kind.	Winds. 7 A. M. Direction.	Winds. 7 A. M. Force.	Winds. 2 P. M. Direction.	Winds. 2 P. M. Force.	Winds. 9 P. M. Direction.	Winds. 9 P. M. Force.	Registering thermom'r. Maximum.	Registering thermom'r. Minimum.	Rain and snow. Beginning rain or snow.	Rain and snow. Ending rain or snow.	Rain and snow. Inches of rain or melted snow.	Rain and snow. Depth of snow, inches.
50	Cir.	10	Cu.	----	--------	n e	1	n e	2	----	0	69	41	--------	--------	------	------
10	Cir.	----	--------	20	St.	n e	5	n e	5	----	0	74	45	--------	--------	------	------
50	Cu. Cir.	70	Cu. Cir.	100	Nim.	n e	4	n e	1	e	1	74	57	*	Night	†	------
80	Cu. Cir.	60	Cu.	100	Nim.	e	5	s e	6	s e	5	84	62	10p m	Night	.04	------
10	Cir.	75	Cir. Cu.	---	--------	s w	3	s w	6	s w	5	90	62	6:30pm	7:30 p m	.40	------
10	Cir.	50	Cu.	30	Nim.	s w	3	s w	6	s w	7	93	65	‡	§	‖	------
75	Cir.	100	Nim.	100	Nim.	s w	5	s w	2	s w	3	88	65	¶11 a m	Morning	1.08	------
100	Nim.	80	Cu.	20	Str.	s w	4	s w	8	s w	1	79	63	9 a. m.	11 a m.	.06	------
100	Nim.	100	Nim.	100	Nim.	n e	1	n e	----	n e	----	67	51	**	††	‡‡	------
20	Cir.	----	--------	---	--------	n e	----	n e	----	s w	3	75	42	--------	--------	------	------
----	--------	----	--------	----	--------	n w	2	s w	6	----	0	82	45	--------	--------	------	------
30	Cir.	30	Cu.	----	--------	s w	5	n w	4	n e	2	83	50	--------	--------	------	------
20	Cu.	5	Cir.	20	Str	n e	4	n e	----	----	0	79	52	--------	--------	------	------
20	Cir.	30	Cu.	100	Nim.	----	0	s e	2	----	0	84	52	7 p. m.	8 p. m.	------	------
100	Nim.	70	Cu.	30	Str.	s e	----	s e	----	n e	----	75	40	Morning	7 p. m.	.29	------
----	--------	15	Cu.	----	--------	n e	----	n e	----	n e	----	78	48	--------	--------	------	------
----	--------	50	Cu.	30	Cir. Str.	n e	----	n e	----	n e	----	81	51	--------	--------	------	------
----	--------	40	Cu.	30	Cir. Str.	s w	----	s e	----	s e	4	84	52	--------	--------	------	------
40	Cir.	80	Cu.	100	Nim.	s w	----	s w	----	s w	----	86	68	6 p. m.	Night	.14	------
----	--------	50	Cu.	100	Nim.	s w	----	s e	6	s w	1	90	66	--------	--------	------	------
100	Nim.	70	Cu.	10	Cir.	---	0	n w	----	n w	----	86	60	Morning	5 a. m.	.51	------
20	Cu.	20	Cir.	30	Cir. St.	n e	----	n e	5	e	1	84	52	--------	--------	------	------
30	Cir. Cu.	20	Cu	70	Cir. St.	n e	6	s e	6	s e	1	89	57	--------	--------	------	------
100	Cir.	100	Nim.	100	Nim.	----	0	n e	2	s e	3	77	61	--------	--------	------	------
100	Nim.	50	Cu.	----	--------	----	0	s w	9	s w	5	89	56	§§	‖‖	¶¶	------
50	Cir.	30	Cu. Cir.	70	St.	n w	5	w	4	w	2	82	48	--------	--------	------	------
60	Cir.	80	Cu. Cir.	50	Cu. Cir.	s w	1	s w	8	----	0	89	56	--------	--------	------	------
100	Cu.	10	Cu.	20	Str.	n w	7	n w	7	n w	2	77	52	--------	--------	------	------
50	Cu. Cir.	----	--------	----	--------	n w	5	n w	7	n w	2	78	43	--------	--------	------	------
10	Cir.	10	Cir.	10	Str.	s w	5	s w	8	s w	1	86	54	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	2.60	------
45	--------	44	--------	42	--------	----	----	----	----	----	----	81.73	53.77	--------	--------	------	------
		44				----	----	----	----	----	----	------	------	--------	--------	------	------

* 2:30 p. m., 9. p. m.
† Trace, .01.
‡ 11:45, night.
§ 11:50, night.
‖ Trace, .02.
⁎ Showers.

** Morning, 4 p. m.
†† 9 a. m., night.
‡‡ Rain, .04, .03.
§§ 10:30 a. m., 2:40 p. m.
‖‖ 11 a. m., 3:00.
¶¶ Rain, .03, trace.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	78	91	69	79⅓	73	74	85	.704	1.070	.599	29.228	29.158	29.138	29.175
2	77	93	78	82⅔	77	71	91	.717	1.094	.870	29.245	29.052	29.093	29.130
3	81	92	85	86	87	74	90	.918	1.108	.610	29.102	29.037	29.017	29.052
4	78	73	67	72⅔	86	95	95	.827	.771	.626	28.955	28.936	29.005	28.965
5	63	74	62	66⅓	89	86	94	.549	.718	.523	29.054	28.917	29.010	28.994
6	66	78	60	68	89	78	94	.570	.744	.487	28.977	28.965	29.069	29.014
7	59	77	55	63⅔	88	77	100	.489	.717	.433	29.197	29.167	29.195	29.186
8	66	81	63	70	84	74	88	.536	.787	.510	29.229	29.167	29.178	29.191
9	64	63	62	63	89	100	100	.529	.676	.556	29.038	28.928	28.948	28.971
10	65	80	63	69⅓	94	74	88	.583	.758	.510	29.157	29.158	29.205	29.173
11	77	88	65	76⅔	82	73	78	.758	.962	.483	29.228	29.184	29.121	29.178
12	78	87	71	78⅔	82	76	90	.785	.976	.682	29.143	29.093	29.064	29.100
13	76	89	72	79	91	80	95	.812	1.097	.745	29.019	28.983	29.004	29.002
14	75	85	74	78	95	83	90	.826	1.008	.758	29.032	28.928	28.870	28.943
15	74	77	59	70	100	82	88	.889	.758	.489	28.846	28.864	28.990	28.900
16	59	71	53	61	82	80	93	.410	.608	.375	29.065	29.080	29.206	29.117
17	60	76	61	65⅔	82	77	83	.426	.691	.442	29.260	29.228	29.274	29.254
18	64	68	69	67	89	90	90	.529	.612	.685	29.270	29.244	29.208	29.241
19	70	68	66	68	90	100	100	.658	.685	.639	29.199	29.172	29.049	29.140
20	68	82	66	72	100	87	100	.685	.950	.639	28.971	28.960	28.986	28.972
21	71	88	70	76⅓	100	80	100	.759	1.060	.733	29.060	29.021	28.980	29.020
22	70	88	68	75⅓	95	84	85	.695	1.111	.577	28.995	28.971	29.077	29.014
23	63	69	69	67	88	85	100	.510	.599	.708	29.159	29.125	28.931	29.072
24	57	64	56	59	100	89	100	.466	.529	.449	28.888	28.902	29.002	28.931
25	66	80	58	68	89	78	94	.570	.800	.452	29.125	29.112	29.097	29.111
26	71	70	68	69⅔	90	100	100	.682	.733	.685	29.041	28.991	28.891	28.974
27	72	81	70	74⅓	95	96	100	.745	1.010	.733	28.888	28.937	28.964	28.930
28	78	82	71	75⅓	90	87	95	.732	.950	.720	29.033	29.098	29.093	29.078
29	78	84	73	78⅓	86	87	95	.827	1.016	.771	29.103	29.058	28.974	29.045
30	78	88	63	76⅓	95	76	84	.914	1.010	.516	28.945	29.035	29.189	29.056
31	64	79	67	70	83	78	75	.497	.772	.489	29.245	29.218	29.256	29.240
Sums	......	......	......	......	......	......	......	......	......	......	....	....	....	....
Means	......	......	......	71.83	89	83	91	.661	.848	.593	....	....	....	29.070
Average	......	......	......	......	83			.701			....	....	....	....

JULY, 1896, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
....	....	10	Cir.	....	....	s w	4	s w	8	s w	1	93	55	....	....	......	......
20	Cir.	25	Cu.	30	Cu. Str.	s w	1	s w	5	s w	2	91	58	....	....	......	......
20	Cir.	90	Cu.	40	Cu Str	s w	3	s w	6	s w	1	94	66	Night	Night	.25	......
80	Cu. Str.	100	Nim.	20	Cu. Str.	w	3	n w	2	....	0	85	60	11 a. m.	6 p. m.	.99	......
100	Nim	50	Cum.	....	....	....	0	n e	2	w	1	79	54	....	....	......	......
100	Cu. Str.	80	Cu.	80	Cir. Str	n w	2	n	5	n	1	77	47	....	....	......	......
....	....	40	Cu.	....	....	n	3	n e	3	....	0	79	46	....	....	......	......
....	....	50	Cu.	15	Str.	n e	1	n e	2	....	0	84	55	....	....	......	......
100	Nim.	100	Nim.	100	Nim.	n e	4	n e	3	n e	1	68	57	*7 a. m.	Night	81	......
100	Nim.	20	Cu. Cir.	....	....	s w	6	s w	7	....	0	85	56	....	....	......	......
30	Cir.	30	Cu.	....	....	s w	3	s w	8	....	0	89	59	....	....	......	......
20	Cir.	80	Cu.	30	Str.	s w	4	s w	10	s w	1	88	66	....	....	......	......
90	Cu. Cir.	95	Cu.	95	Cu.	s w	6	s w	10	....	0	90	65	4 p. m.	4:15 p m	.01	......
100	Cu.	60	Cu.	100	Nim	s w	3	s w	5	s w	4	87	66	8 p. m.	Night	.18	......
100	Nim.	60	Cir.	30	Cir. St.	n w	4	n w	4	n w	4	79	48	....	....	......	......
30	Cir.	50	Cu.	....	....	n w	2	n w	3	....	0	73	39	....	....	......	......
....	....	....	....	10	Cir.	....	0	n		s e	....	78	47	....	....	......	......
100	Cir.	100	Nim.	100	Nim.	s w	...	s w	5	...	0	74	68	2 p. m.	5 p. m.	......	......
100	Nim.	100	Nim.	100	Nim.	s w	1	s	6	s	3	78	64	7 a. m.	....	......	......
100	Nim.	90	Cu.	....	....	n w	1	n w	5	...	0	83	64	....	8:30 a m	.44	......
100	Nim.	50	Cu.	90	Cir.	....	0	s w	3	s w	1	89	64	Night	Night	.09	......
100	Nim.	30	Cir. Cu.	....	....	s w	1	s w	8	s w	2	86	48	....	....	......	......
20	Cir.	100	Nim.	100	Nim.	n e	...	n w	....	s e	...	70	55	2 p. m	....	......	......
100	Nim.	100	Nim.	....	....	n e	1	n e	2	...	0	64	48	....	8 a. m.	.49	......
0	0	50	Cum.	5	Cu.	n	3	s w	7	...	0	60	52	....	....	......	......
75	Cir.	100	Nim.	100	Nim.	s	3	n	8	n w	5	71	64	†10 a. m.	9 midn.	3.18	......
20	Cir.	100	Nim.	....	....	n w	2	s w	3	...	..	82	60	2:30 p m	3 p. m	09	......
....	....	100	Nim.	5	Cir.	....	0	s w	1	....	0	88	64	2:20 p m	2:30 p m	.09	......
50	Cu	60	Cu.	80	Cu.	....	0	s w	5	s w	4	88	69	....	....	......	......
95	Cu.	....	....	....	....	n w	4	n w	5	n w	2	89	61	....	....	......	......
....	....	80	Cu. Cir.	100	Cu.	n e	1	n e	2	n e	2	80	61	....	....	......	......
....	....	....	....	....	....	....	...	....	....	....	..	....	....	....	....	6.73	......
56	....	63	....	39	....	....	....	....	....	....	..	82.06	57.64	....	....	......	......
58						....	....	....	....	....	....	......	......	....	....	......	......

* Rain. † Continued night, .30 inch rain.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	67	77	70	71⅓	95	95	95	.626	.884	.720	29.061	28.860	28.861	28.927
2	66	76	68	70	89	86	100	.570	.772	.685	29.050	29.017	29.158	29.075
3	71	84	65	73⅓	95	75	100	.720	.877	.618	29.074	29.058	29.020	29.051
4	72	89	78	78	90	88	90	.706	1.201	.732	29.031	29.005	28.9[illegible]0	29.005
5	78	92	80	83⅓	86	85	91	.827	1.269	.931	28.975	28.980	29.004	28.986
6	81	91	75	82⅓	96	84	95	1.010	1.228	.826	29.018	29.040	29.043	29.034
7	78	87	78	77⅔	100	84	95	.812	1.074	.771	29.121	29.138	29.116	29.125
8	78	85	78	80⅓	86	100	86	.827	1.208	.827	29.066	28.917	28.933	28.972
9	84	88	78	83⅓	91	84	100	1.065	1.111	.958	28.943	28.954	28.945	28.947
10	74	71	71	72	95	100	100	.798	.759	.759	29.039	29.032	29.043	29.038
11	71	91	70	77⅓	95	81	100	.720	1.174	.733	29.054	29.026	29.074	29.051
12	72	78	60	70	90	78	94	.706	.744	.487	29.190	29.184	29.209	29.194
13	71	79	65	71⅔	45	82	100	.840	.813	.618	29.205	29.197	29.202	29.201
14	70	80	64	71⅓	100	83	94	.783	.843	.563	29.164	29.178	29.189	29.177
15	70	84	71	75	90	91	100	.653	1.065	.759	28.986	29.035	29.079	29.033
16	71	76	51	66	90	81	100	.682	.731	.374	29.099	29.0[illegible]4	29.159	29.111
17	66	74	57	65⅔	78	81	100	.502	.680	.466	29.188	29.198	29.151	29.179
18	72	72	57	67	90	81	94	.706	.631	.436	29.185	29.161	29.210	29.169
19	50	68	50	56	93	85	100	.335	.577	.361	29.356	29.375	29.306	29.346
20	60	70	68	64⅓	88	80	94	.456	.586	.548	29.290	29.170	29.079	29.180
21	70	76	64	70	95	86	94	.695	.772	.563	28.971	28.911	28.921	28.934
22	66	80	68	71⅓	100	91	100	.639	.931	.695	28.867	28.831	28.751	28.816
23	70	74	60	68	90	86	88	.658	.718	.456	28.957	28.980	29.098	29.012
24	61	71	52	61⅓	88	76	100	.473	.572	.388	29.163	29.123	29.149	29.145
25	64	79	65	69⅓	83	82	94	.497	.813	.583	29.103	29.053	28.957	29.038
26	65	70	50	61⅔	94	80	100	.583	.586	.361	28.921	29.030	29.197	29.049
27	56	69	50	58⅓	87	79	100	.391	.564	.361	29.303	29.346	29.429	29.359
28	54	72	56	60⅔	87	81	94	.362	.631	.420	29.507	29.423	29.317	29.416
29	59	77	68	66⅓	82	77	98	.410	.717	.510	29.300	29.162	29.099	29.187
20	64	79	54	65⅔	89	82	87	.529	.813	.362	28.833	28.769	28.919	28.840
31	56	69	56	60⅓	75	90	75	.336	.685	.336	29.037	29.069	29.186	29.097
Sums	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Means	......	......	......	69.97	89	84	95	.625	.838	.587	......	......	......	29.087
Average	......	......	......	......		89			.683		......	......	......	......

AUGUST, 1896, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
100	Nim.	100	Nim.	100	Nim.	s e	5	s e	3	----	0	79	60	6:30 a m	Night	.91	----
100	Nim.	30	Cum.	----	----	n w	2	n w	1	----	0	82	55	----	----	----	----
----	----	40	Cum.	----	----	s w	2	s w	8	----	0	86	61	----	----	----	----
100	Nim.	60	Cir.	----	----	s w	4	s w	8	s w	4	90	65	7:45 a m	8:45 a m	.31	----
10	Cir.	05	Cu.	50	Cir.	s w	5	s w	10	s w	5	93	64	----	----	----	----
30	Cir.	80	Cu.	50	Cir.	s w	4	s w	5	s w	4	92	68	----	----	----	----
100	St.	20	Cu.	10	Str.	n	1	s w	5	----	0	91	67	----	----	----	----
40	Cir.	100	Nim.	----	----	s	5	s w	6	s w	4	94	71	2 p. m.	2:15 p m	17	----
50	Cir.	50	Cu.	100	Nim.	s w	8	n w	2	s w	2	91	65	*	11:35	.02	----
20	Cir.Nim.	100	Nim.	10	St.	s w	8	s w	7	----	0	89	62	12:30pm	†	‡	----
10	Cu.	30	Cir.	100	Nim.	s w	3	s w	----	s w	----	92	63	7:30 p m	11 p. m.	.37	----
20	Cir.	100	Cu. St	80	St.	n	3	n e	----	n e	1	81	58	----	----	----	----
50	Cu.	40	Cu.	40	Cu.	----	0	s e	4	s e	2	88	60	9 a. m.	9:20 a m	.02	----
80	Cu.	80	Cu.	----	----	s w	5	s w	8	s w	----	86	68	§	‖	.69	----
70	Cir.	100	Cu.	20	Cu. St.	s w	----	s w	5	s w	----	86	62	3:30	4 p. m	.09	----
70	Cu.	50	Cir. Cu.	----	----	n w	----	n w	6	n w	3	88	44	----	----	----	----
20	Cir.	50	Cu.	10	Cir.	s w	1	s w	4	s w	1	75	48	Night	Night	.08	----
50	Cir.	50	Cu.	----	----	s w	1	n e	7	n e	2	72	40	----	----	----	----
----	----	50	Cu.	80	Cir.Str.	n e	2	n e	2	----	0	72	45	----	----	----	----
50	Cir.	100	Cu.	90	Cu.	s	2	s e	5	n w	5	72	49	----	----	----	----
100	Nim.	100	Nim.	90	Cu.	n w	2	n w	4	n w	2	78	58	7 a. m.	9 a. m	.01	----
100	Nim.	70	Cu.	100	Ni.	n w	3	n w	7	s w	4	83	58	¶	**	††	----
70	Cu.	20	Cu.Cir.	20	St.	w	10	s w	9	s w	3	75	48	----	----	----	----
----	----	80	Cu.	----	----	e	1	w	3	----	0	76	43	----	----	----	----
----	----	10	Cu.	20	Cir.	s w	1	s w	10	s w	7	80	59	----	----	----	----
100	Nim.	20	Cu.	----	----	n w	5	w	6	w	1	76	43	‡‡	9 a. m.	§§	----
----	----	30	Cu.	----	----	s w	3	s w	4	s w	4	71	37	----	----	----	----
20	Cir.	20	Cu.	----	----	----	0	n w	2	----	0	76	44	----	----	----	----
10	Cir.	30	Cu.	----	----	s w	5	s w	8	s w	3	80	54	----	----	----	----
10	Cir.	100	Cu.	80	Cu.Str.	----	0	s w	9	n	2	83	44	----	----	----	----
20	Cir.	80	Cu.	----	----	n e	1	n e	8	n e	1	70	35	----	----	----	----
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	4.73	----
45	----	58	----	32	----	----	----	----	----	----	----	82.16	54.77	----	----	----	----
45						----	----	----	----	----	----	----	----	----	----	----	----

* 11:30, 10 p. m.
† Morning, 2 p. m.
‡ Rain, 1.06, .48.
§ 7 a. m., 3:30 p. m.
‖ 7:15 a. m., 4 p. m.
¶ Morning, 9 p. m.
** 9 a. m., 11 p. m.
†† Rain, .03, .39.
‡‡ Morning, 8 a. m.
§§ Rain, .14, .01.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	49	70	53	57⅓	92	80	86	.322	.586	.348	29.354	29.245	29.263	29.287
2	56	77	65	66	81	77	94	.363	.717	.583	29.214	29.009	28.985	29.069
3	58	65	46	56⅓	100	100	100	.483	.618	.311	29.075	29.154	29.217	29.149
4	51	68	55	51⅓	100	79	94	.374	.543	.405	29.307	29.115	29.105	29.176
5	55	62	51	56	94	100	100	.405	.556	.374	28.879	28.752	28:774	28.802
6	56	56	52	54⅔	94	87	100	.420	.391	.388	28.804	28.853	29.032	28.896
7	51	63	57	57	100	88	67	.374	.491	.407	29.104	29.096	29.109	29.103
8	57	74	60	63⅔	87	81	88	.407	.680	.456	29.159	29.143	29.131	29.144
9	62	81	65	69⅓	100	83	100	.556	.873	.618	29.092	28.975	28.987	29.018
10	60	85	70	71⅔	88	75	90	.456	.909	.658	28.980	28.908	28.877	28.922
11	68	79	60	69	90	87	100	.612	.856	.518	28.903	28.966	29.075	28.981
12	61	65	60	62	100	100	94	.537	.618	.487	29.179	29.218	29.293	29.230
13	61	70	60	63⅔	100	95	94	.537	.695	.487	29.389	29.298	29.255	29.314
14	61	71	65	65⅔	94	95	100	.505	.720	.618	29.198	29.170	29.140	29.169
15	60	69	51	60	88	89	100	.456	.564	.374	29.230	29.140	29.143	29.171
16	52	67	60	59⅔	93	84	100	.361	.556	.518	29.071	28.939	28.793	28.934
17	58	68	51	59	100	85	100	.483	.577	.374	28.860	28.853	28.994	28.902
18	52	62	50	54⅔	93	94	100	.361	.523	.361	29.039	28.811	28.863	28.904
19	55	52	37	48	87	86	90	.362	.334	.199	28.947	29.044	29.168	29.053
20	45	68	44	52⅓	84	90	100	.251	.612	.249	29.243	29.140	29.041	29.141
21	53	63	55	57	93	77	94	.375	.446	.405	29.024	28.979	29.011	29.005
22	45	46	37	42⅔	84	84	90	.251	.262	.199	29.047	29.240	29.289	29.192
23	32	59	40	43⅔	89	82	91	.162	.410	.225	29.419	29.297	29.267	29.328
24	46	68	55	56⅓	84	75	87	.262	.509	.376	29.276	29.149	29.039	29.155
25	56	67	56	59⅔	94	89	94	.405	.591	.420	28.989	29.015	29.017	29.007
26	66	70	55	63⅔	100	80	100	.639	.586	.433	29.140	29.164	29.146	29.150
27	45	56	37	46	92	81	90	.275	.363	.199	29.223	29.243	29.323	29.263
28	41	56	56	51	91	81	100	.235	.363	.449	29.304	29.183	29.116	29.201
29	56	62	57	58⅓	100	100	100	.449	.556	.466	28.924	28.720	28.350	28.665
30	52	54	53	53	100	100	100	.388	.418	.403	28.442	28.527	28.796	28.588
Sums	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Means	......	......	......	57.62	93	87	95	.402	.564	.412	......	......	......	29.064
Average	......	......	......	......		92			.459		......	......	......	......

SEPTEMBER, 1896, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
10	Cir	20	Cu.	----	--------	----	0	n e	1	s e	1	73	45	-------	-------	------	------
100	Cu.Str.	50	Cu.	100	Nim.	s	5	s	13	s	7	78	54	10 p. m.	Morn.	.40	------
100	Ni.	20	Cu.	----	--------	n e	4	n e	7	n e	2	68	37	-------	-------	------	------
80	Cir.	20	Cu.	100	Nim.	----	0	n e	5	n e	8	70	42	-------	-------	------	------
100	Nim.	100	Nim.	----	--------	----	0	----	0	s e	4	63	42	6:30 a m	Night	.78	------
93	Cu. Nim.	100	Cu.	----	--------	n w	8	n w	9	s w	2	63	38	-------	-------	------	------
----	--------	20	Cu.	----	--------	----	0	s w	4	s w	3	63	43	-------	-------	------	------
----	--------	----	--------	----	--------	s w	3	s e	8	s e	5	75	53	-------	-------	------	------
100	Nim.	----	--------	----	--------	s e	3	s e	10	s e	3	80	56	*9 a. m.	-------	.01	------
100	Cu.	20	Cir.	----	--------	----	0	s w	7	s w	6	86	60	Morn.	-------	‡	------
100	Nim.	100	Cu.	100	Nim.	----	0	----	0	n e	2	79	46	*8 p. m.	-------	‡	------
100	Nim.	100	Nim.	100	Nim.	----	0	n e	3	n e	3	65	52	Contin	ued.	1.90	------
100	Nim.	100	Nim.	100	Nim.	----	0	n e	1	----	0	71	59	Mist	ing	------	------
100	Nim.	100	Nim.	100	Nim.	----	0	----	0	----	0	72	54	†2 p. m.	Night	.14	------
100	Nim.	80	Cu.	20	Str.	----	0	n e	3	n e	1	69	41	-------	-------	------	------
----	--------	93	Cu.	100	Nim.	s e	1	s	4	s w	2	70	48	3 p. m.	-------	------	------
100	Nim.	70	Cu.	----	--------	n w	3	n w	4	n w	1	70	41	Con't	8 a. m.	.28	------
70	Cir.	100	Nim.	100	Nim.	s w	1	s w	5	n w	1	70	41	2:30 p m	-------	------	------
100	Nim.	50	Cu.	----	--------	n w	5	n w	12	s w	1	55	27	Con't	8 a. m.	.37	------
10	Cu.	10	Cir.	80	Cu.	s w	1	s w	8	s w	1	69	40	-------	-------	------	------
70	Cu.	50	Cu.	100	Nim.	s w	2	s w	5	n w	3	65	40	10 p. m.	11 p. m.	.03	------
100	Nim.	50	Cu.	----	--------	n e	4	n e	5	----	0	53	22	-------	-------	------	------
----	--------	10	Cu.	----	--------	----	0	s w	9	s w	2	60	27	-------	-------	------	------
20	Cir.	30	Cir.	50	Cir.	s w	4	s w	8	s w	6	69	41	-------	-------	------	------
100	Nim.	20	Cir.	100	Cu.	----	0	s w	8	s w	----	68	47	6:40 a m	10 a. m.	.05	------
----	--------	20	Cir.	100	Nim.	s w	----	s w	8	n e	2	73	40	8 p. m.	Night	.83	------
100	Cu	50	Cir.	30	Cir.	n w	3	n w	3	n e	1	56	30	-------	-------	------	------
50	Cu.Cir.	100	Cu.	100	Nim.	----	0	n e	2	n e	1	36	38	8 p. m.	-------	.37	------
100	Nim.	100	Nim.	10	Nim.	n e	1	s	1	s	2	61	47	Con't	Night	1.51	------
100	Nim.	100	Nim.	100	Nim.	s w	3	s w	5	s w	2	55	39	12 a. m.	8 p. m.	.09	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	-------	-------	6.73	------
70	--------	56	--------	53	--------	----	----	----	----	----	----	67.50	43.00	-------	-------	------	------
		60				----	----	----	----	----	----	------	------	-------	-------	------	------

* Morning.
† Rain.
‡ Trace.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	55	50	39	48	94	93	100	.405	.335	.238	29.145	29.246	29.226	29.206
2	44	60	38	49⅛	100	82	100	.289	.426	.229	29.168	29.189	29.217	29.191
3	46	63	43	50⅔	92	77	92	.286	.446	.254	29.265	29.160	29.168	29.198
4	50	67	44	53⅔	93	84	92	.335	.556	.265	29.208	29.209	29.216	29.211
5	49	65	49	54⅓	100	84	100	.348	.516	.348	29.243	29.169	29.229	29.214
6	50	53	42	48⅓	93	86	88	.335	.348	.222	29.293	29.245	29.247	29.262
7	47	43	32	40⅔	92	83	89	.289	.231	.162	29.317	29.275	29.345	29.312
8	26	48	32	35⅓	87	78	100	.123	.260	.181	29.414	29.401	29.417	29.411
9	26	56	40	40⅔	100	81	100	.141	.363	.248	29.454	29.377	29.366	29.399
10	43	62	38	47⅔	92	88	100	.254	.491	.229	29.324	29.303	29.297	29.308
11	45	62	35	47⅓	84	83	100	.251	.460	.204	29.254	29.215	29.213	29.227
12	49	54	47	50	92	87	85	.322	.362	.273	29.213	29.210	29.246	29.223
13	45	60	40	48⅓	100	76	91	.300	.396	.225	29.186	29.127	29.118	29.144
14	37	66	42	48⅓	81	68	100	.176	.438	.267	29.106	29.047	29.047	29.067
15	51	69	49	56⅓	86	79	71	.321	.564	.247	28.961	28.839	28.956	28.919
16	37	48	37	40⅔	81	78	81	.178	.260	.178	28.947	28.841	28.966	28.918
17	36	39	31	35⅓	90	78	89	.191	.173	.155	28.914	28.991	29.052	28.996
18	30	42	24	32	78	83	100	.130	.222	.129	29.084	29.130	29.168	29.127
19	31	45	39	38⅓	89	76	100	.155	.228	.238	29.110	28.963	28.751	28.941
20	36	48	39	41	80	85	91	.170	.285	.216	28.867	28.877	28.867	28.870
21	33	37	30	33⅓	89	81	100	.168	.178	.167	28.930	29.048	29.047	29.018
22	28	51	33	37⅓	88	79	89	.142	.296	.168	29.125	29.066	29.049	29.080
23	35	46	32	37⅔	90	84	89	.183	.262	.162	28.878	28.735	28.707	28.773
24	31	43	24	32⅔	89	83	86	.155	.231	.111	28.830	28.945	29.069	28.948
25	24	52	29	35	86	73	100	.111	.282	.160	29.164	29.075	29.004	29.081
26	29	64	34	42⅓	100	77	100	.166	.464	.196	29.040	29.041	29.189	29.090
27	37	65	55	52⅓	100	84	87	.221	.516	.376	29.289	29.119	29.090	29.159
28	37	64	56	52⅓	100	89	100	.221	.529	.449	29.081	29.043	29.101	29.075
29	59	72	54	61⅔	94	81	100	.469	.631	.418	29.088	28.989	28.923	29.000
30	58	62	40	53⅓	94	88	100	.452	.491	.280	28.658	28.668	28.628	28.651
31	44	44	34	40⅔	84	84	100	.241	.241	.196	28.667	28.791	28.871	28.776
Sums	......	......	......	......	......	......	......	......	......	......	....	....	....	....
Means	......	......	......	44.61	91	82	94	.243	.370	.232	....	....	....	29.090
Average	......	......	......	......		89			.282		....	....	....	....

OCTOBER, 1896, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
40	Cu.Cir.	100	Cu.	----	--------	n e	1	n e	3	----	0	55	28	--------	--------	------	------
20	Cir.	----	--------	----	--------	----	0	n e	3	----	0	56	28	--------	--------	------	------
----	--------	----	--------	----	--------	----	0	n e	----	e	----	64	28	--------	--------	------	------
--	--------	----	--------	----	--------	s w	----	s w	2	s w	3	67	35	--------	--------	------	------
95	Cu.	60	Cu.	100	Nim.	s w	2	s w	2	n e	1	66	43	3 p. m.	--------	------	------
100	Nim.	95	Cu.	----	--------	n e	1	n e	4	n e	3	53	38	--------	8 a. m.	.12	------
85	Cu.Cir.	100	Cu.	----	--------	n w	4	n w	5	n e	1	44	19	--------	--------	------	------
----	--------	60	Cir.	----	--------	n e	2	s e	1	----	0	51	22	--------	--------	------	------
----	--------	----	--------	----	--------	s e	4	s e	7	s e	5	56	29	--------	--------	------	------
----	--------	50	Cir.	----	--------	s e	4	s e	6	n e	3	63	31	--------	--------	------	------
----	--------	50	Cir.	10	Str.	n e	1	n e	5	n e	2	62	30	--------	--------	------	------
50	Cir.	100	Cu.	100	Cu.	n e	1	n e	3	w	2	55	34	--------	--------	------	------
100	Nim.	20	Cir.	----	--------	n e	1	n e	4	---	0	61	23	--------	--------	------	------
----	--------	80	Cu.	----	--------	n w	3	n w	3	n w	2	67	32	--------	--------	------	------
----	--------	20	Cir.	----	--------	n w	2	n w	8	n w	5	60	28	--------	--------	------	------
90	Cu.Cir.	60	Cir.	----	--------	n w	3	n w	6	n w	2	49	29	--------	--------	------	------
100	Nim.	100	Nim.	80	Cu Cir.	----	0	n w	4	n w	4	39	15	*7:30am	--------	‡	------
90	Cir.	90	Cu.	80	Cu.	s e	4	s w	4	----	0	42	17	--------	--------	------	------
50	Cir.	100	Nim.	100	Nim.	s w	6	s w	12	s w	5	46	25	†4 p. m	Night	.81	------
20	Str.	75	Cu.	80	Cu.	s w	3	s w	4	s w	4	49	27	*6 a. m.	--------	‡	------
80	Cu.	95	Cu.	----	--------	n w	7	s w	6	s w	2	38	17	--------	--------	------	------
----	--------	30	Cu.Cir.	----	--------	s w	1	s w	9	s w	2	51	22	--------	--------	------	------
50	Cu.	50	Cu Cir.	----	--------	s w	2	s w	10	----	0	48	22	--------	--------	------	------
50	Cu.	70	Cu.	30	St.	s w	3	s w	6	s w	5	46	16	--------	--------	------	------
60	Cu. Str.	90	Cu.Cir.	----	--------	s w	1	s w	11	s w	4	52	26	--------	--------	------	------
----	--------	----	--------	----	--------	s w	5	s w	7	----	0	65	30	--------	--------	------	------
----	--------	60	Cu.	----	--------	----	0	s w	9	s e	4	66	32	--------	--------	------	------
50	Cu.Str.	60	Cir.	30	Cir.	s	9	s w	8	s w	6	68	56	8 a. m.	10:30am	.42	------
70	Cu.Cir.	90	Cu.	100	Nim.	s w	4	s e	8	s e	15	73	52	Night	Night	.21	------
20	Cu.	100	Nim.	100	Nim.	s e	11	s	14	s w	17	63	38	Night	Night	‡	------
100	Nim.	50	Cu.	----	--------	s w	11	s	14	w	1	46	27	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	-----	------	--------	--------	1.06	------
45	--------	58	--------	26	--------	----	----	----	----	----	----	55.81	29.19	--------	--------	------	------
		42				----	----	----	----	----	----	------	------	--------	--------	------	------

* Snow. † Rain. ‡ Trace.

20

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	41	54	35	43⅓	82	74	100	.212	.308	.204	28.884	29.070	29.097	29.017
2	35	58	55	49⅓	100	76	94	.204	.365	.405	29.128	29.008	29.060	29.065
3	35	60	55	50	100	76	100	.204	.396	.433	29.146	29.100	28.921	29.056
4	53	54	55	54	100	100	100	.408	.418	.433	28.883	28.866	28.806	28.852
5	45	38	33	38⅔	100	100	100	.300	.229	.188	28.471	28.293	28.421	28.395
6	38	48	32	39⅓	100	85	100	.229	.285	.181	28.915	28.954	28.965	28.945
7	39	38	30	35⅔	91	81	100	.216	.186	.167	28.830	28.879	28.898	28.869
8	29	33	20	27⅓	100	89	100	.160	.168	.108	28.833	28.874	28.901	28.869
9	25	31	27	27⅔	100	100	100	.135	.174	.147	29.006	29.001	29.027	29.011
10	32	41	38	37	100	82	100	.181	.212	.229	29.070	28.950	28.699	28.906
11	38	40	35	37⅔	81	82	100	.186	.208	.204	28.805	28.905	29.065	28.925
12	27	35	27	29⅔	88	96	100	.129	.188	.147	29.158	29.126	29.140	29.140
13	24	30	20	24⅔	100	100	100	.129	.167	.108	29.188	29.183	29.267	29.213
14	25	41	30	32	100	74	100	.135	.190	.167	29.207	29.011	28.951	29.056
15	38	58	46	47⅓	91	70	92	.208	.337	.286	28.942	28.947	28.936	28.942
16	52	67	62	60⅓	93	79	83	.361	.522	.460	28.977	28.983	28.991	28.967
17	57	57	61	58⅓	94	100	94	.436	.466	.503	29.117	29.104	29.060	29.094
18	62	62	37	53⅔	100	100	81	.556	.556	.178	28.890	28.808	28.891	28.863
19	26	28	21	25	87	76	71	.123	.117	.060	29.370	29.432	29.512	29.438
20	23	29	29	27	72	77	77	.089	.123	.123	29.517	29.437	29.232	29.395
21	31	34	28	31	100	100	76	.174	.196	.117	29.069	29.039	29.198	29.102
22	27	33	27	29	75	80	75	.111	.150	.111	29.492	29.437	29.282	29.404
23	34	42	50	42	79	100	100	.155	.267	.361	29.225	29.110	29.198	29.178
24	39	43	40	40⅔	91	83	91	.216	.231	.225	29.383	29.423	29.383	29.396
25	46	47	47	36⅔	100	100	100	.311	.323	.328	29.237	29.146	29.047	29.143
26	49	62	42	51	100	100	100	.348	.556	.267	28.929	28.918	28.869	28.905
27	40	36	23	33	100	100	72	.248	.212	.069	28.857	28.881	29.090	28.943
28	18	19	17	18	68	100	100	.067	.103	.094	29.310	29.362	29.418	29.363
29	18	20	17	18⅓	100	100	100	.098	.108	.094	29.492	29.437	29.479	29.469
30	16	16	13	15	100	100	100	.090	.090	.078	29.447	29.429	29.417	29.431
Sums														
Means				37.09	93	89	93	.214	.261	.217				
Average						92			.231					

NOVEMBER, 1896, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
30	Cu. Cir.	----	--------	----	--------	s w	6	w	14	----	0	54	24	--------	--------	------	------
80	Cu Cir	100	Cu.	20	Cu.	s e	3	s e	10	s e	10	60	38	--------	--------	------	------
30	Cu.	100	Nim.	100	Nim.	s w	2	s e	3	s e	13	60	40	*	3:30	Tr.	------
100	Nim.	100	Nim.	100	Nim.	s w	6	s w	3	n e	3	55	40	Morn.	--------	------	------
100	Nim.	100	Nim.	100	Nim.	n e	5	s	19	w	18	55	30	†	10 a. m.	------	1.0
80	Cu.	50	Cu.	80	Cu.	s w	9	s w	6	s w	1	48	30	--------	Morn.	------	¼
100	Nim.	100	Nim.	100	Nim.	s w	12	s w	16	s w	13	38	24	Morn.	Morn.	------	------
100	Nim.	100	Nim.	100	Nim.	s w	11	s w	11	s w	3	37	12	‡	§	.20	------
100	Nim.	95	Nim.	----	--------	----	0	s w	1	s w	1	32	20	8 a. m.	--------	.05	⅓
100	Nim.	100	Nim.	100	Nim.	s e	1	s e	9	s e	13	47	28	3 p. m.	Night	.10	⅛
100	Nim.	100	Nim.	Ha	ze.	s w	13	s w	13	s w	7	40	22	--------	--------	------	------
90	Co.	50	Cu. Cir.	100	Nim.	n w	4	w	6	n w	5	36	23	‖8 p. m.	Night	.02	¼
30	Cu.	100	Nim.	----	--------	n w	8	n w	10	n w	2	31	16	‖1:30pm	--------	Tr.	------
20	Cir.	----	--------	----	--------	s e	9	s w	13	s w	11	41	24	--------	--------	------	------
60	Cu. Cir.	----	--------	20	Str.	s w	6	s w	12	s w	7	58	25	--------	--------	------	------
----	--------	70	Cir.	50	Cu.	s w	11	s w	17	s w	17	67	54	--------	--------	------	------
100	Nim.	100	Nim.	50	Cu.	s w	2	n e	3	e	3	62	54	¶	2 p. m.	.02	------
20	Cu.	100	Nim.	100	Nim.	s w	16	s w	16	n w	9	62	24	11 a. m.	4 p. m	.04	------
100	Nim.	80	Cu.	20	Str.	n w	3	n e	2	n e	2	31	20	--------	--------	------	------
100	Nim.	100	Nim.	100	Nim.	n e	3	n e	3	e	3	32	22	--------	--------	------	1.00
100	Nim.	100	Nim.	----	--------	----	0	n w	7	n w	4	34	22	--------	--------	.31	------
----	--------	60	Cu.	20	Cir.	----	0	s e	2	----	0	34	27	--------	--------	------	------
100	Nim.	100	Nim.	100	Nim.	----	0	s w	6	s w	10	50	29	**	Night	.04	------
100	Nim.	50	Cu.	90	Cu.	n w	----	n e	2	s e	4	44	37	Rain	Night	.04	------
100	Nim.	100	Nim.	20	Str.	s w	6	s w	10	s w	8	48	43	††	1 p. m.	Tr.	Tr.
100	Nim.	100	Nim.	100	Nim.	s w	10	s w	13	s w	24	64	41	3 p. m.	Night	.16	------
20	Cu.	100	Nim.	100	Nim.	s w	12	s w	13	s w	12	41	18	‡‡	4 p. m.	.02	------
100	Nim.	100	Nim.	100	Nim.	n w	7	s w	8	n w	5	26	16	‖8 a. m.	§§	------	------
100	Nim.	100	Nim.	20	Str.	n w	2	n w	6	n w	5	21	15	Snow	§§	------	------
95	Nim.	100	Nim.	100	Nim.	n w	4	w	2	----	0	19	8	‖8 a. m.	Night	.05	⅛
----	--------	----	--------	----	--------	----	----	----	----	----	----	--------	--------	--------	--------	1.05	4.0
72	--------	82	--------	60	--------	----	----	----	----	----	----	44.23	27.53	--------	--------	------	------
71 (mean of the three per-cent columns)						----	----	----	----	----	----	--------	--------	--------	--------	------	------

* 3 p. m., 12 p. m.
† Continued, 1 p. m.
‡ Morning, 8 p. m.
§ 10 a. m., 9 p. m.
‖ Snow.

¶ Rain, 8:30 a. m.
** Rain, 7 p. m.
†† Rain, 11 a. m.
‡‡ Rain, 12 a. m.
§§ Flurries.

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	8	16	9	11	54	63	56	.034	.059	.036	29.487	29.437	29.457	29.460
2	7	23	10	13⅓	52	72	78	.031	.089	.054	29.481	29.387	29.317	29.395
3	13	23	20	18⅔	100	59	70	.078	.073	.075	29.317	29.267	29.297	29.294
4	23	33	28	28	100	100	100	.123	.188	.153	28.839	28.778	28.937	28.851
5	34	33	33	33⅓	100	100	100	.196	.188	.188	28.839	28.727	28.919	28.828
6	32	38	33	34⅓	100	91	100	.181	.208	.188	29.009	29.015	29.045	29.023
7	31	36	33	33⅓	100	100	100	.174	.212	.188	29.199	29.165	29.250	29.205
8	34	36	34	34⅔	100	100	100	.196	.212	.196	29.115	28.907	28.856	28.959
9	36	47	36	39⅔	100	85	100	.212	.273	.212	28.856	28.666	28.855	28.792
10	34	47	34	38⅓	100	77	100	.196	.249	.196	28.816	28.758	28.990	28.855
11	32	48	33	37⅔	100	85	89	.181	.285	.168	29.030	28.998	28.930	28.986
12	35	58	39	44	80	82	82	.162	.394	.195	28.793	28.779	28.570	28.714
13	34	38	34	35⅓	79	81	79	.155	.186	.155	28.769	28.808	28.919	28.832
14	30	34	30	31⅓	78	89	89	.130	.175	.148	29.116	29.062	29.009	29.062
15	28	28	23	26⅓	100	100	86	.153	.158	.106	29.029	29.049	29.150	29.076
16	26	30	17	24⅓	75	78	100	.105	.130	.093	29.259	29.179	29.243	29.227
17	23	33	32	29⅓	86	89	100	.106	.168	.181	29.183	29.043	28.895	29.040
18	32	34	20	28⅔	100	100	85	.181	.196	.091	28.839	28.971	29.197	29.002
19	13	36	21	23⅓	81	80	100	.063	.170	.113	29.260	29.218	29.115	29.198
20	21	29	15	21⅔	100	100	82	.113	.160	.070	28.884	28.999	29.019	28.967
21	6	28	21	18⅓	75	100	100	.043	.153	.113	29.024	28.919	28.859	28.934
22	21	26	20	22⅓	100	100	85	.113	.141	.091	28.776	28.668	28.924	28.789
23	14	28	-10	10⅔	81	88	100	.067	.135	.028	29.194	29.217	23.303	29.238
24	0	20	19	13	100	100	100	.044	.108	.103	29.379	29.668	29.635	29.561
25	12	26	27	21⅔	80	100	100	.050	.141	.147	29.529	29.396	29.228	29.384
26	28	30	27	28⅓	100	89	100	.153	.148	.147	29.325	29.449	29.582	29.452
27	25	29	20	24⅔	87	88	85	.117	.142	.091	29.709	29.723	29.708	29.713
28	18	39	37	31⅓	100	55	90	.098	.131	.199	29.558	29.402	29.382	29.447
29	35	36	36	35⅔	100	100	100	.204	.212	.212	28.486	28.367	28.377	28.410
30	38	44	39	40⅓	100	100	100	.229	.289	.238	28.359	28.362	28.389	28.370
31	38	39	40	39	100	100	100	.229	.238	.248	28.432	28.379	28.332	28.381
Sums	......	......	......	......	......	......	......	......	......	......	....	....	....	....
Means	......	......	......	28.13	91	89	92	.133	.181	.143	....	....	....	29.047
Average	......	......	......	......		91			.152		....	....	....	....

DECEMBER, 1896, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction	Force.	Direction.	Force.	Direction	Force.	Maximum.	Minimum.	Beginning rain or snow.	Ending rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
80	Cu.	50	Cu.				0	n w	6		0	17	7				
40	Cir.						0	s e	2	s e	1	23	9				
100	Nim.	100	Nim.				0		0		0	23	18	*Morn	10 a. m.	.05	1
100	Nim.	100	Nim.	100	Nim.		0	s w	8	s w	10	34	26	*Morn.	1 p. m.	.06	1
100	Nim.	80	Cu.	100	Nim.	s	6	s w	7	s w	9	34	32	†Morn.	10 a. m.	.01	
100	Nim.	100	Nim.	100	Nim.	s w	1	s w	1	s w	1	38	30	‡6 p. m.	Night	.13	⅕
100	Nim.	100	Nim.	100	Nim.	n e	1	s w	3	s w		36	30				
100	Nim.	100	Nim.	100	Nim.	s		s w	11	s w	7	36	32	†6 p. m.	Night	.1	
100	Nim.	50	Cir.			s w	4	s w		s w		47	28				
100	Nim.	50	Cu.	100	Nim.	s w		w	8		0	47	23				
50	Cir.	50	Cu.	50	Cir.		0	s w	10	s w	11	50	28				
50	Cir.	50	Cu.				0	s w	8	s w	5	58	34				
100	Nim.	100	Nim.			n w	5	n w	5		0	39	24				
100	Nim.	90	Cu.			n e	3	n e	3	n e	6	34	22				
100	Nim.	100	Nim.	10	Cir.	n e	5	n e	1		0	30	17	*6 a. m.	2 p. m.	.12	2
100	Nim.	40	Cu.				0		0		0	30	13				
80	Cir.	100	Nim.	100	Nim.	s w	1	s w	5	w	9	33	23				
100	Nim.	90	Cu.				0	n w	2		0	32	7	*Morn	8 a. m	.02	⅕
50	Cir.	50	Cu.	100	Nim.		0		0	s w	0	36	13				
100	Nim.	100	Nim.	100	Nim.		0	s w	2	s w	1	29	3	*Morn	Aftern.	.09	2
100	Cu.	100	Nim.	100	Nim.	s w	1	s w	2		0	28	6	§			
100	Nim.	100	Nim.	100	Nim.	s	4	e	2	n w	1	27	14	*Morn.	Night	.21	4
20	Cir.	50	Cu.			n e	5	n e	4	n e	5	28	-16				
100	Nim.	40	Cir. Cu.	100	Str.	n w	5	w	6	w	20	22	8				
50	Str.	80	Cu.	100	Str.	s w	3	s w	8		0	28	11				
100	Str.	100	Cu. Str.	100	Str.	s w	1	s	6	s e	7	30	21				
100	Str.	50	Cu.			s	4	s	8	s w	14	30	17				
75	Str.	40	Cir.	100	Nim.	s	7	s w	4	w	6	40	18	†8:30pm	Morn.	.07	
100	Nim.	100	Nim.	100	Nim.	s w	7	s w	11	s w	1	38	36				
100	Nim.	100	Nim.	100	Nim.	s w	1	s w		s w		44	38	†6 p. m.			
100	Nim.	100	Nim.	100	Nim.	n e		e	6	s e	6	41	36	Cont.	Night	.04	
																.80	11
87		76		60								34.26	19.61				
		74															

* Snow. † Rain. ‡ Rain and snow. § Snow flurries.

BULLETINS

OF THE

AGRICULTURAL COLLEGE EXPERIMENT STATION

ISSUED DURING THE

YEAR ENDING JUNE 30, 1897

EXPERIMENT STATION BULLETINS.

INSPECTION OF COMMERCIAL FERTILIZERS.

BY R. C. KEDZIE, CHEMIST.

Bulletin 135.—Chemical Department.

The law providing for the inspection and regulating the sale of commercial fertilizers was passed by the Michigan legislature in 1885, but did not "take effect" till ninety days after the final adjournment of that body. The law has thus been in operation for ten years. A retrospect of the workings of the law may not be out of place at this time.

One influence that assisted in the passage of the law was the demand of honest and reliable manufacturers for such a law to prevent the competition of unscrupulous dealers who offered for sale materials having very little value as fertilizers, in regard to which the farmer had no ready means of determining which was valuable and which valueless. Thus one manufacturer offered a mixture of soap-boilers' waste and leached ashes as a high grade superphosphate; another party shipped in from Ohio marl and offered it for sale as Buckeye phosphate. The college authorities were also desirous to screen the public from fraud. Our legislators readily saw the need of such a law when they found neighboring states requiring thorough inspection and regulation of sale, thus making our state a dumping ground for worthless fertilizers from other states.

The effect of the law has been to exclude worthless fertilizers from our state, or make their sale here very short-lived. Thus one party in a neighboring state shipped in nearly a thousand tons of ground furnace slag, mixed with a little salt, which they offered for sale at $20 a ton, and advertised the mixture in extravagant terms as a valuable fertilizer. When this wonderful compound, "Every pound made up of plant food," was analyzed and the farmers were informed that its real value as manure was only a few cents, they concluded not to pay the retail price

of $22 a ton, and the sale suddenly stopped. The party came to Lansing breathing out threatenings of prosecution for damages in the sum of $50,000 unless the chemist would retract his statement in regard to the small value of this fertilizer. The bluff did not work and the threatened "suit in the United States court for exemplary damages in the sum of $50,000" has been postponed. It is pleasant to state that few such cases have come up.

Under the operation of this law there have been gathered in the open market and analyzed in ten years four hundred and ninety (490) samples of commercial fertilizers, from one hundred and forty-seven (147) manufactories. Of these total numbers, however, many are duplicated from year to year both as to specimens and manufactories. For example, a firm sends into our market seven kinds of fertilizers every year, and these seven kinds and the firm are counted year by year in making up the list.

The first year under this law we had fifteen (15) kinds of fertilizers from six (6) manufacturers; this year, sixty-four (64) from sixteen (16) manufacturers. The larger part of the fertilizers came from Buffalo, Detroit, Chicago and Cleveland, in the order named.

WHAT FERTILIZERS SHALL BE INSPECTED?

This question is sometimes raised by dealers in fertilizers who claim that they sell for parties out of the state, who have neglected to take out a license which would cover all the retailers of the fertilizer in the state, that their sales are too small to justfy the expense for a license. The state law does not directly reach the manufacturers in other states and can only apply to parties in this state. If the manufacturer and wholesale dealer will not protect his customers in this state, they would do well to choose wholesale dealers who will look to the interests of their retail dealers. In any event it is necessary to protect the dealers who fully comply with the law, and this can only be done by impartially enforcing the law on all dealers.

Another party claims that his sales are too small to pay for a license; that he is attempting to establish a trade, and when the trade is established on a paying basis, the license will be taken.

In some states the license fee is based upon the number of tons of fertilizer sold during the year, but our law makes the license for the year the same whatever the amount sold. The law is explicit, requiring every fertilizer sold or offered for sale, the retail price of which exceeds $10 a ton, to be inspected and licensed before the sale is legal.

Another party claims that certain materials are chemical substances and are sold for other purposes than as fertilizers; such as nitrate of soda and muriate of potash. To exempt a material from the control of this law would throw out the phosphates, nitrates, the salts of ammonia, etc., because they are chemical substances and may be used for other purposes. But if any substance is offered for sale *as a fertilizer*, it plainly comes under the provisions of this law. It is just as important for the farmer to know how much potash is present in a Stassfurth salt, or the quantity of available nitrogen in nitrates and ammonia salts, as to be told how much of these materials is contained in mixed fertilizers. The farmer needs to know the quantity of useful materials present in the

costly fertilizers offered for sale, whether in separate salts or in a mixture of materials, because the salts may vary in purity as well as compounds. It is plain that *every material offered for sale as a fertilizer should be inspected and licensed* if the price exceeds $10 a ton. The State Board of Agriculture has no power to modify or change the law, but it is its duty to enforce the law in such way as to protect both the farmer and the honest manufacturer.

If these foreign manufacturers are unwilling to place their goods in the open light of day by showing their real composition and thus come in fair competition with reputable dealers, it would be prudent for dealers to refuse to handle their goods, and thus save themselves from the severe penalty for selling unlicensed fertilizers. It would be wise for farmers to refuse to buy fertilizers whose composition they do not know, and of whose intrinsic value they have no assurance. It would be well to leave such fertilizers severely alone. It is the manifest duty of the Board of Agriculture to enforce the law against the dealers in unlicensed fertilizers. When such dealer has paid a fine of $100 for the sale of an unlicensed fertilizer, he will conclude that there may be more profit in dealing in legitimate goods.

MANUFACTURERS SHOULD PROTECT THEIR RETAIL DEALERS.

By the proviso to section 3 of the law a dealer in this State is not required to take out a license for the sale of any fertilizer if the manufacturer has taken out a license for such fertilizer. In this way the manufacturer can protect all his agents in this State by payment of a single fee. Otherwise each dealer must take out a license. The object of the law is not merely to collect a revenue, but to secure the analysis and certification of every fertilizer sold in the State. If, then, any manufacturer neglects or refuses to take out a license for his goods, it would be a matter of prudence for all dealers to refuse his goods, and sell only the fertilizers of such manufacturers as will protect their agents in the State. If outside manufacturers neglect their State agents, then the law exacts the fee for license from each dealer in the State.

OBJECT OF INSPECTION OF COMMERCIAL FERTILIZERS.

The law does not prescribe any standard for the composition of a commercial fertilizer, the manufacturer being free to make his own standard, the law simply requiring that the fertilizers offered for sale shall be up to the standard set up by the manufacturer. The license to sell does not certify to the value of the fertilizer, but simply states that the manufacturer or dealer offers for sale a fertilizer for which a certain content of nitrogen, potash and phosphoric acid is claimed, and that samples of such fertilizers have been deposited with the secretary of the college with affidavit regarding the composition. Analysis is then made of each of these fertilizers, gathered in the open market as far as possible, and the results of such analysis published in bulletin. The *claimed* composition and *found* composition are arranged in parallel lines, so that the real composition can be compared at a glance with the composition claimed for it by the manufacturer. In this way the buyer can see at once by this bulletin whether the fertilizer is as good as the claims made for it.

ESTIMATION OF VALUES.

Severe criticism has been made of the effort to fix an estimate of money value of the leading materials that make up a mixed fertilizer, the value per pound of available nitrogen, phosphoric acid and potash. A word of explanation may not be out of place. It is manifestly impossible to fix prices upon these materials that would everywhere be just and proper, because they are not equally distributed and of uniform cost in all places.

The attempt has been made to fix a scale of prices in the Eastern States by finding the price of leading materials—bones, mineral phosphates, ammonia and potash—in such markets as New York and Philadelphia, and from such data to determine the average cost of the nitrogen, phosphoric acid and absolute potash they contain. In this way some approximate idea is formed of the commercial value of these materials. This, however, is not to be taken as expressing the *agricultural value*, or what cash profit the farmer will secure from their use.

WHAT TO LEARN FROM THE TABLE OF ANALYSIS.

As previously stated the three most valuable materials in commercial fertilizers are potash, phosphoric acid and available nitrogen. Each of these has a commercial value which may be stated in dollars and cents. Only these three substances are considered in the inspection of commercial fertilizers because the other materials are of too little value to be purchased at high prices. By placing before the farmer the composition as claimed by the manufacturer and the composition of the material as found in the market, he can find whether the goods are up to standard and can also form an estimate of the market value of the goods. If the analysis shows more of a given substance than is claimed, the goods are better than claimed; but if much less is found on analysis than is claimed, then the goods are proportionately of less value to the farmer.

The market value of these materials varies somewhat from year to year. The value of nitrogen estimated as ammonia is now 16 cents a pound; of available phosphoric acid, 8 cents a pound; of insoluble phosphoric acid, 2 1-2 cents a pound; and potash is worth 6 cents a pound.

Since there are 20 times 100 pounds in a ton, if we multiply the value of one pound by 20 we find the value of one per cent of any material in a ton. We may thus construct a table for estimating the value of any materials found in the results of analysis. One per cent means 20 pounds in a ton, and if the material is worth 8 cents a pound, then each per cent equals $1.60 for a ton.

Multiply the per cent of	available P_2O_5 by	$1 60
" "	insoluble P_2O_5 by	50
" "	ammonia by	3 20
" "	potash by	1 20

The sum of these products will give the market value of the fertilizer.

As this bulletin may fall into the hands of some who have never seen the law concerning the inspection of commercial fertilizers, the act is printed in full.

[Session Laws of 1885, No. 26.]

AN ACT to provide for the inspection of commercial fertilizers and to regulate the sale thereof.

Section 1. *The People of the State of Michigan enact,* That any person or persons who shall sell or offer for sale in this State any commercial fertilizer, the retail price of which exceeds ten dollars per ton, shall affix on the outside of every package containing such fertilizer a plainly printed certificate, stating the number of net pounds therein; the name or trade mark under which such article is sold; the name of the manufacturer, the place of manufacture, and a chemical analysis, stating the percentage of nitrogen in an available form; of potash soluble in water, and of phosphoric acid in available form (soluble or reverted) and the insoluble phosphoric acid.

Sec. 2. Before any commercial fertilizer is sold or offered for sale, the manufacturer, importer, or party who causes it to be sold or offered for sale within this State, shall file with the secretary of the State Board of Agriculture a certified copy of the analysis and certificate referred to in section one, and shall also deposit with said secretary a sealed glass jar containing not less than two pounds of such fertilizer, with an affidavit that it is a fair sample of the article thus to be sold or offered for sale.

Sec. 3. The manufacturer, importer or agent of any commercial fertilizer, the retail price of which exceeds ten dollars per ton as aforesaid, shall pay annually to the secretary of the State Board of Agriculture, on or before the first day of May, a license fee of twenty dollars for each and every brand of fertilizer he offers for sale in this State: *Provided,* That whenever the manufacturer or importer shall have paid this license fee his agents shall not be required to do so.

Sec. 4. All such analysis of commercial fertilizers required by this act shall be made under the direction of the State Board of Agriculture and paid for out of the funds arising from the license fees provided for in section three. At least one analysis of each fertilizer shall be made annually.

Sec. 5. The secretary of the State Board of Agriculture shall publish in his annual report a correct statement of all analysis made and certificates filed in his office, together with a statement of all moneys received for license fees, and expended for analysis. Any surplus from license fees remaining on hand at the close of the fiscal year shall be placed to the credit of the experimental fund of said board.

Sec. 6. Any person or persons who shall sell or offer for sale any commercial fertilizer in this State without first complying with the provisions of sections one, two, and three of this act, or who shall attach or cause to be attached to any such package or fertilizer an analysis stating that it contains a larger percentage of any one or more of the constituents or ingredients named in section one of this act than it really does contain shall, upon conviction thereof, be fined not less than one hundred dollars for the first offense, and not less than three hundred dollars for every subsequent offense, and the offender shall also be liable for damages sustained by the purchaser of such fertilizer on account of such misrepresentation.

Sec. 7. The State Board of Agriculture by any duly authorized agent is hereby authorized to select from any package of commercial fertilizer exposed for sale in this State, a quantity, not exceeding two pounds, for a sample, such sample to be used for the purposes of an official analysis and for comparison with the certificate filed with the secretary of the State Board of Agriculture and with the certificate affixed to the package on sale.

Sec. 8. All suits for the recovery of fines under the provisions of this act shall be brought under the direction of the State Board of Agriculture.

Approved March 10, 1885.

For the information of the public the fertilizers that have been inspected and licensed for 1896 are given in the following pages.

The gathering of specimens of commercial fertilizers in the open market for analysis, and the analytical work have for the most part been performed by Thorn Smith, Assistant in the Chemical Department of the Experiment Station, with the assistance of L. H. Van Wormer.

R. C. KEDZIE,
Chemist of Experiment Station.

AGRICULTURAL COLLEGE,
July, 1896.

Analysis of Commercial

Manufacturer.	Trade Name.	Dealer and Locality.
Armour & Co., Chicago, Ill.	Bone, Blood, and Potash	W. M. Cahow, Reading
Armour & Co., Chicago, Ill.	Bone Meal	Manufacturer
Armour & Co., Chicago, Ill.	Ammoniated Bone and Potash	John Sweitzer, Disco; W. M. Cahow, Reading
Armour & Co., Chicago, Ill.	All Soluble	E. A. Cunningham, Hillsdale; W. M. Cahow, Reading
Cleveland Dryer Co., Cleveland, Ohio.	Ohio Seed Maker	E. W. Spencer, Petersburg
Cleveland Dryer Co., Cleveland, Ohio.	Ohio Seed Maker with Potash	E. W. Spencer, Petersburg
Cleveland Dryer Co., Cleveland, Ohio.	Buckeye Ammoniated Bone Superphosphate	E. W. Spencer, Petersburg
Cleveland Dryer Co., Cleveland, Ohio.	Phosphate	E. W. Spencer, Petersburg
Cleveland Dryer Co., Cleveland, Chio.	Potato and Vegetable Fertilizer.	E. W. Spencer, Petersburg
Crocker Chemical Co., Buffalo, N. Y.	Crocker's Ammoniated Bone Superphosphate	Seth Lathrop, Richmond
Crocker Chemical Co., Buffalo, N. Y.	Crocker's Ammoniated Wheat and Corn Phosphate	Manufacturer
Crocker Chemical Co., Buffalo, N. Y.	Crocker's Potato, Hop, and Tobacco Phosphate	Manufacturer
Crocker Chemical Co., Buffalo, N. Y.	Crocker's Special Potato Manure	Webster Cobb & Co., Charlotte; Joy & Owens, Albion.
Crocker Chemical Co., Buffalo, N. Y.	Crocker's Superphosphate No. 2.	Manufacturer
Crocker Chemical Co., Buffalo, N. Y.	Crocker's General Crop Phosphate	Smith & Tucker, Mt. Clemens.

Fertilizers in Michigan, 1896.

	Available nitrogen. Estimated as ammonia.	Phosphoric Acid. Available P_2O_5	Phosphoric Acid. Insoluble P_2O_5.	Phosphoric Acid. Total P_2O_5.	Potash Soluble in Water. Estimated as K_2O.	Potash Soluble in Water. Estimated as K_2SO_4.
Claimed	5 to 6	6 to 8		10 to 12	7 to 8	
Found	*5.14	9.77	1.46	11.23	6.53	12.08
Claimed	3 to 4	10 to 14		25 to 28		
Found	4.01	14.96	7.55	22.51		
Claimed	3 to 4	4 to 6		8 to 10	1.5 to 2	
Found	3.34	8.15	1.53	9.68	1.37	2.53
Claimed	3.5 to 4.5	2 to 3		10 to 12	4 to 5	
Found	4.31	9.74	1.61	11.35	5.80	10.73
Claimed	1.5 to 2.5	10 to 12		15 to 17		
Found	2.37	10.25	3.50	13.75		
Claimed	1.5 to 2.5	10 to 12		15 to 17	2 to 3	
Found	3.31	7.27	5.37	12.64	2.83	5.24
Claimed	3 to 4	9 to 10		11 to 12	1 to 2	
Found	3.57	5.96	2.99	11.95	1.5	2.77
Claimed		13 to 15		15 to 17		
Found	.4	13.40	2.05	15.45		
Claimed	4 to 5	8 to 10		10 to 14	4 to 5	
Found	3.56	8.29	3.48	11.77	3.26	6.08
Claimed	3.5 to 4.5	10 to 12	1 to 2	11 to 14	1.08 to 2.	2 to 3
Found	3.95	11.07	1.41	12.48	1.36	2.42
Claimed	2.5 to 3.5	10 to 13	1 to 2	11 to 15	1.6 to 2.7	3 to 5
Found	2.75	9.52	.79	10.31	2.19	4.05
Claimed	2.5 to 3.5	10 to 12	1 to 2	11 to 13	3.25 to 4.30	6 to 8
Found	2.56	9.85	1.23	11.08	3.67	6.79
Claimed	4.5 to 5.5	8 to 9	1 to 2	9 to 11	5.4 to 6.4	10 to 12
Found	4.66	8.26	1.82	10.08	5.3	9.80
Claimed		11 to 13	1 to 2	12 to 15	1.25 to 2.	2.5 to 3.5
Found	.12	10.92	1.87	12.79	1.42	2.63
Claimed	1 to 2	7 to 10	1 to 2	8 to 12	1.08 to 2.5	2 to 4
Found	1.25	7.75	2.69	10.44	.94	1.74

Analysis of Commercial

Manufacturer.	Trade Name.	Dealer and Locality.
Crocker Chemical Co., Buffalo, N. Y.	Crocker's Universal Grain Grower	Joy & Owens, Albion
Crocker Chemical Co., Buffalo, N. Y.	Crocker's New Rival Ammoniated Superphosphate	Webster, Cobb & Co., Charlotte
Crocker Chemical Co., Buffalo, N. Y.	Crocker's Practical Ammoniated Superphosphate	Manufacturer
Crocker Chemical Co., Buffalo, N. Y.	Crocker's Vegetable Bone Superphosphate	Webster, Cobb & Co., Charlotte; F. O. Chevey, Kalamazoo
Crocker Chemical Co., Buffalo, N. Y.	Crocker's Ground Bone Meal	Joy & Owens, Albion
James Boland, Jackson, Mich.	Blackman Fertilizer	Manufacturer
Darling & Co., Chicago, Ill.	Pure Ground Bone	Manufacturer
Darling & Co., Chicago, Ill.	Chicago	Manufacturer
Darling & Co., Chicago, Ill.	Sure Winner	Manufacturer
Darling & Co., Chicago, Ill.	Farmers' Favorite	Manufacturer
Darling & Co., Chicago, Ill.	Vegetable Grower	Manufacturer
Darling & Co., Chicago, Ill.	Darling's Odorless Lawn Dressing	Manufacturer
W. S. Dunbar, St. Joseph, Mich.	Meat and Bone	Manufacturer
Grand Rapids Glue Co., Grand Rapids, Mich.	Non Plus Ultra	Perkins & Hess, Grand Rapids
Great Eastern Fertilizer Co., Rutland, Vermont	Corn Fertilizer	G. R. Lovejoy, Lenox
Great Eastern Fertilizer Co., Rutland, Vermont	Vegetable, Vine, and Tobacco Fertilizer	Manufacturer
Great Eastern Fertilizer Co., Rutland, Vermont	Soluble Bone and Potash	Manufacturer

Fertilizers in Michigan, 1896.

	Available nitrogen.	Phosphoric Acid.			Potash Soluble in Water.	
	Estimated as ammonia.	Available P_2O_5.	Insoluble P_2O_5.	Total P_2O_5.	Estimated as K_2O.	Estimated as K_2SO_4.
Claimed	1 to 2	7 to 10	1 to 2	8 to 12	2.7 to 4	5 to 7
Found	1.42	6.17	3.63	9.80	4.39	8.12
Claimed	1.5 to 2.5	10 to 12	1 to 3	11 to 15	1.6 to 3	3 to 5
Found	1.73	10.34	2.53	12.87	1.76	3.26
Claimed	1 to 2	8 to 10	1 to 2	9 to 12	1.08 to 2	2 to 3
Found	1.41	7.42	4.45	11.87	1.47	2.72
Claimed	6 to 7	6 to 7	1 to 2	7 to 9	5.94 to 8	11 to 15
Found	6.14	6.56	.61	7.20	6.50	12.03
Claimed	2.5 to 4			25 to 28		
Found	2.44			25.99		
Claimed	1.05	5.38	1.31		.27	
Found	1.03	4.45	1.77	6.22	.24	.48
Claimed	3 to 4	8 to 9	15 to 16			
Found	3.55	14.23	9.26	23.49		
Claimed	2.5 to 3	7 to 9	4 to 5		1 to 2	
Found	2.7	9.09	3.63	12.77	1.99	3.68
Claimed	1.5 to 2.5	7 to 9	4 to 5		3 to 4	
Found	2.27	8.52	3.15	11.67	3.65	6.15
Claimed	3.5 to 4.5	8 to 9	5 to 5.5		4 to 5	
Found	4.78	9.28	4.20	13.48	4.18	7.72
Claimed	4 to 5	7 to 9	1 to 2		7 to 9	
Found	4.23	8.21	2.97	11.18	7.66	14.17
Claimed	3 to 4	8 to 9	2 to 3		3 to 4	
Found	4.49	8.26	1.92	10.18	5.06	9.26
Claimed						
Found	6.10	4.08	1.94	5.97		
Claimed	4.48 to 5.20			17 to 22		
Found	4.45		1.46	6.62		
Claimed	1 to 2	8 to 10	1 to 3		4 to 6	
Found	2.54	8.83	.51	9.34	4.56	8.44
Claimed	2.5 to 3.5	8 to 12	1 to 3		3.5 to 4.5	
Found	2.82	9.67	1.25	10.92	3.56	6.59
Claimed		11 to 13			2 to 4	
Found	.83	11.89	.95	12.84	1.40	2.59

Analysis of commercial

Manufacturer.	Trade name.	Dealer and locality.
Great Eastern Fertilizer Co., Rutland, Vermont	English Wheat Grower	Manufacturer
Great Eastern Fertilizer Co., Rutland, Vermont	Dissolved Bone	G. R. Lovejoy, Lenox
S. M. Isbell & Co., Jackson, Mich.	Isbell's Celery Grower	Manufacturer
Iron Cliffs Co., Negaunee, Mich.	Bone Meal	Manufacturer
Jarecki Chemical Co., Sandusky, O.	Fish and Potash Potato Food	J. H. McMann, Richmond
Jarecki Chemical Co., Sandusky, O.	Lake Erie Fish Guano	J. H. McMann, Richmond; C. Godfrey & Co., Benton Harbor
Lister's Agricultural Chemical Works, Newark, New Jersey	Lister's "Success" Fertilizer	P. P. Andrews, Washington
Lister's Agricultural Chemical Works, Newark, New Jersey	Lister's Special Potato Fertilizer	Manufacturer
Michigan Carbon Works, Detroit, Mich.	Dessicated Bone with Potash	B. F. Pixley, St. Joseph
Michigan Carbon Works, Detroit, Mich.	Homestead Potato Grower	B. F. Pixley, St. Joseph; J. H. Farnum, Kalamazoo
Michigan Carbon Works, Detroit, Mich.	Homestead Vegetable Grower	O. E. Thompson, Ypsilanti; J. H. Farnum, Kalamazoo
Michigan Carbon Works, Detroit, Mich.	Homestead, a Bone Black Fertilizer	John Griffiths, Three Rivers; F. McIntyre, Mt. Clemens
Michigan Carbon Works, Detroit, Mich.	Dessicated Bone	B. F. Pixley, St. Joseph
Michigan Carbon Works, Detroit, Mich.	Perfection Fruit Grower	J. H. St. John, Utica; J. H. Farnum, Kalamazoo
Michigan Carbon Works, Detroit, Mich.	Jarves Drill Phosphate	J. Bartholomew, Romeo
Joseph Lister, Chicago, Ill.	Raw Ground Bone	C. H. Farnum
Niagara Fertilizer Works, Buffalo, N. Y.	Niagara Wheat and Corn Producer	McKay & Stafford, Romeo; Allen & Henry, Reading

fertilizers in Michigan, 1896.

	Available nitrogen.	Phosphoric acid.			Potash soluble in water.	
	Estimated as ammonia.	Available P_2O_5.	Insoluble P_2O_5.	Total P_2O_5.	Estimated as K_2O.	Estimated as K_2SO_4.
Claimed...... Found........	1 to 2 1.35	8 to 12 5.79	1 to 3 3.55	.... 9.34	2 to 4 2.21	.... 4.09
Claimed...... Found........	....	13 to 17 12.76	.... 2.10	.... 14.86	....	....
Claimed...... Found........	.2 to 3 3.16	....	....	8 to 9 16.17	10 to 12 10.35	.... 19.15
Claimed...... Found........	4.20 4.93	....	....	23. 22.26	....	....
Claimed...... Found........	2 to 3 2.30	6 to 7 10.44	1 to 2 1.00	.... 11.44	3.5 to 4 5.51	.... 10.19
Claimed...... Found........	2 to 3 1.00	10 to 12 13.12	1.5 to 2 2.81	.... 15.93	1 to 2 .52	.... .96
Claimed...... Found........	1.24 to 1.65 1.94	9.5 to 11 9.05	2 to 3 3.20	.... 12.25	2 to 3 2.11	.... 3.90
Claimed...... Found........	2 to 3 2.25	8 to 10 8.23	.... 2.69	.... 10.92	3 to 4 2.68	.... 4.96
Claimed...... Found........	1.25 to 2.25 2.08	....	....	25 to 30 27.60	1.5 to 2.5 3.55	.... 6.57
Claimed...... Found........	1.94 to 2.68 2.50	8.5 to 10 9.23	.5 to 1.5 1.51	9 to 11.5 10.74	5 to 6 4.64	.... 8.58
Claimed...... Found........	4 6 to 5.35 6.70	5 to 6.5 7.61	.... .59	.... 8.20	6.5 to 7.5 5.93	.... 10.97
Claimed...... Found........	1.85 to 2.40 3.18	8 to 11 9.07	.5 to 1.5 1.82	8.5 to 12.5 10.89	1.5 to 2 2.20	.... 4.07
Claimed...... Found........	1.5 to 2.5 1.8	....	....	25 to 30 29.58	....	....
Claimed...... Found........	.8 to 1.25 1.21	10 to 11 12.62	1 to 2 1.66	11 to 13 14.28	7 to 8.5 6.78	.... 12.54
Claimed...... Found........	1.25 to 2 1.45	8 to 9 8.64	.... .95	.... 9.59	.75 to 1.25 1.02	.... 1.89
Claimed...... Found........	4.68 3.30	25.60	....	.... 24.56	....	....
Claimed...... Found........	1.5 to 2.5 1.61	8 to 10 7.22	1 to 2 2.40	.... 9.62	2.16 to 3.24 2.7	4 to 6 4.99

Analysis of commercial

Manufacturer.	Trade name.	Dealer and locality.
Niagara Fertilizer Works, Buffalo, N. Y.	Niagara Triumph	Seth Lathrop, Richmond
Niagara Fertilizer Works, Buffalo, N. Y.	Niagara Grain and Grass Grower	Allen & Henry, Reading
Niagara Fertilizer Works, Buffalo, N. Y.	Niagara Potato, Tobacco and Hop Fertilizer	Manufacturer
Northwestern Fertilizing Co., Chicago, Ill.	Potato Grower	Henry Rupert, Battle Creek
Northwestern Fertilizing Co., Chicago, Ill.	Challenge Corn Grower	Manufacturer
Northwestern Fertilizing Co., Chicago, Ill.	Pure Ground Bone	Henry Rupert, Battle Creek
Northwestern Fertilizing Co., Chicago, Ill.	Fine Raw Bone	Manufacturer
Northwestern Fertilizing Co., Chicago, Ill.	Garden City Superphosphate	D. H. Cunningham, Reading; Henry Rupert, Battle Creek
Northwestern Fertilizing Co., Chicago, Ill.	Prairie Phosphate	Manufacturer
Northwestern Fertilizing Co., Chicago, Ill.	Raw Bone and Superphosphate Mixture	Manufacturer
Speidel Swartz & Co., Grand Haven, Mich.	Celery Hustler	N. Robbins, Grand Haven

The following Fertilizers found on sale have not been licensed and the sale as fertilizers is illegal:

Fitch Fertilizer Co., Bay City, Mich.	*Bone Meal	Manufacturer
Fitch Fertilizer Co., Bay City, Mich.	*Big Crop Phosphate	Manufacturer
Detroit Sanitary Works, Detroit, Mich.	*Clover Leaf	E. R. Smith & Co., Birmingham
Swift & Co., Chicago	*Swift's Raw Bone Meal	Alfred J. Brown Co., Grand Rapids

* Not licensed. Sale unlawful. See Sec. 6 of the law.

***Fertilizers in Michigan*, 1896.**

	Available nitrogen.	Phosphoric acid.			Potash soluble in water.	
	Estimated as ammonia.	Available P_2O_5.	Insoluble P_2O_5.	Total P_2O_5.	Estimated as K_2O.	Estimated as K_2SO_4.
Claimed	3 to 4	8 to 10	1 to 2	....	2.16 to 3.24	4 to 6
Found	3.49	7.16	2.40	10.56	2.98	5.51
Claimed	1 to 2	7 to 9	1 to 3	....	1.08 to 2.16	2 to 4
Found	1.40	7.24	3.61	10.85	1.48	2.74
Claimed	2 to 3	8 to 10	1 to 2	....	2.70 to 3.78	5 to 7
Found	2.43	7.90	1.23	9.21	2.80	5.18
Claimed	3 to 4	7 to 9	....	....	....	4 to 5
Found	3.46	6.49	4.22	10.71	2.58	4.77
Claimed	2.5 to 3.5	8 to 9	....	....	....	1 to 2
Found	3.14	9.87	.59	10.46	1.21	2.24
Claimed	3 to 4	....	....	18 to 22	....	....
Found	4 05	....	....	17.77	....	....
Claimed	4 to 5	....	....	22 to 24	....	....
Found	5.12	....	....	19.70	....	....
Claimed	2.5 to 3	8 to 9	4 to 4.5	....	.054 to 1.08	....
Found	3.02	7.48	3.50	10.98	.95	1.76
Claimed	2 to 2.5	6 to 8	3 to 4	....	....	....
Found	2.61	7.57	3.79	11.38	....	....
Claimed	3 to 3.5	7 to 8	....	....	....	1 to 2
Found	4.22	8.54	4.02	12.56	.85	1.57
Claimed	9.60	2.93	.74	3.67	1.1 to 2.08	....
Found	7.84	3.17	.69	3.86	1.27	2.35

FATTENING LAMBS.—A COMPARISON OF FODDERS.

BY HERBERT W. MUMFORD.

Bulletin No. 136.—Farm Department.

SUMMARY.

1. Lambs can be profitably fattened without clover hay.

2. Under the conditions existing in this experiment a pound of gain was most economically produced where a ration of corn, roots and corn stalks was fed. With this ration a pound of gain cost 3.58 cents. The average cost of a pound of gain in all the lots was 4.53 cents. The cost of a pound of gain was the least where corn stalks was the fodder ration, and greatest where millet hay was the fodder ration.

3. The number of pounds of dry matter required to produce a pound of gain was least where corn stalks and clover hay was the fodder ration, and greatest where millet hay was the fodder ration.

4. Since the buying and selling prices are important factors of the profit and loss account, it would be well to note that the lambs used in this experiment were purchased at 2.37 cents per pound, and sold at 4.6 cents per pound.

5. From the standpoint of the dry matter required to produce a pound of gain, the results go to show that where clover hay was fed *with some other fodder* it required less pounds of dry matter to produce a pound of gain than where the other fodder was fed alone. This advantage is not attributed to the clover hay but to the variety in the ration, for by referring to Table III it will be noticed that it required less pounds of dry matter to produce a pound of gain where corn stalks and alfalfa were fed alone than it did where clover hay was fed alone; and again, it took fewer pounds of dry matter to produce a pound of gain with clover hay and corn stalks than it did with either alone as the fodder ration.

6. To show that all the lambs were well fattened the following letter from the commission firm in East Buffalo, who sold the lambs for the Lansing parties who purchased them of the Station might be of interest:

"East Buffalo, *Feb'y 19, 1896.*

"Jones and Brumm, *Lansing, Mich.:*

"Messrs—The only fault with this lot of lambs is that they are too heavy. It has been almost impossible to sell heavy lambs; several loads of good ones have been lying around here for a week unsold. This lot of yours sold fully one-fourth higher than the same kind and

weight was selling at. Sheep may be called steady and lambs a shade higher, due more to snow storm which is likely to shorten the supply.

"Swope, Hughes, Waltz & Benstead."

7. The results of this set of experiments show that any of the following fodders may be substituted in the ration of fattening lambs in the place of clover hay:

1. Alfalfa. **By feeding to each lamb an average of 1.3 pounds of alfalfa per day, with corn and roots, the lambs so fed gained an average of 2.45 pounds per week, or 34.4 pounds during the whole period of 14 weeks. This lot made a little better gain than any other lot in the experiment.**

2. Millet hay. **More care is necessary in feeding millet hay to fattening lambs than any other coarse fodder. Unless fed in small quantities it induces scours. Each lamb in the lot receiving millet hay was fed an average of .9 of a pound per day throughout the feeding period and gained 25.8 pounds per lamb.**

3. Oat straw. **Lambs fed on oat straw as the fodder part of the ration consumed an average of 1.25 pounds per lamb per day. The average total gain of each lamb was 28.5 pounds or 2.03 pounds per week. The results of this experiment seemed to indicate that the value of oat straw in the fodder ration of fattening lambs has been hitherto underrated.**

4. Corn stalks. **The principal objection to feeding corn stalks to lambs is that when fed in the bundle from racks, the lambs waste a large per cent of the fodder. The only satisfactory method of feeding them is in racks after they have been cut in a cutting box or ensilage machine. The stalks fed in this experiment were cut with an ordinary ensilage cutter and fed from racks. The average daily ration of this fodder was 1.18 pounds for each of the 10 lambs. Each lamb in the lot receiving corn stalks as the fodder ration gained an average of 2.15 pounds per week or 30.2 pounds for the whole period. Such flattering results should make every sheep feeder value his corn stalks highly, and induce him to take every possible precaution to properly preserve them.**

5. Bean straw. **This experiment substantiates a general opinion that bean straw is a good substitute for clover hay. An average feed of 1.33 pounds of bean straw, together with the roots and corn, produced an average gain of 2.11 pounds per day for 14 weeks or a total gain of 29.6 pounds for each lamb.**

INTRODUCTION.

For several years the supply of clover hay in Michigan has been gradually diminishing on account of the repeated dry seasons and the ravages of the insect enemies of the clover plant, necessitating whenever possible the substitution of other fodders in the rations of live stock. Farmers have become at times greatly concerned lest they should be obliged to abandon further attempts to grow clover in Michigan. While it has been generally conceded that there is no fodder that can altogether take the place of well cured clover hay in the ration of fattening sheep and lambs, experiments in fattening sheep with but little clover hay or possibly none cannot fail to be timely.

Those who have had experience in fattening both old sheep and lambs will know that it is much easier to fatten the former than the latter without clover hay. Many experienced feeders have gone so far as to say that it is not possible to successfully fatten lambs without clover hay. With these ideas in mind the general plan of the experiments with fattening lambs during the season of 1895 and 1896 was outlined.

One hundred grade Shropshire lambs were purchased in the vicinity of the Agricultural College. These lambs were very ordinary individuals, no better than the average lambs which can be picked up in almost any section in the State. They were delivered at the College on or before August 20, 1895. From that time until September 3d, they were kept on an ordinary pasture of mixed grasses. On the third day of September they were turned on a field of rape after being weighed. The field of rape was good during the early part of September but the very dry weather of the latter part of that month and early October furnished just the conditions favorable to the growth and reproduction of plant lice which did serious damage to the rape. As a result the gains made were less than those secured from equal areas of rape in previous years at this station and elsewhere.

One hundred and thirty-five sheep were pastured on the seven measured acres of rape for 8 weeks, during which time they gained an average of 8 pounds per head or 1 pound each per week. Heretofore the gains per lamb per week on rape have been from 2 to 3 pounds. As stated before the differences in gain made in different seasons were due most probably almost wholly to the lice on the rape plant.

GENERAL PLAN OF THE EXPERIMENT.

The lambs were divided into 10 pens of 10 lambs each. This work was very carefully done, the lambs in each pen being selected so that they would correspond in size and thrift with those in the other pens.

No effort was made to compound rations with a definite nutritive ratio. One pen was taken as a basis or standard for comparison. This standard pen was fed a ration of corn, roots and clover hay, the ration which has given the best results in previous seasons. As the aim was to determine the relative value of certain of our common fodders for fattening lambs, the nine other pens were fed either alfalfa, millet hay, oat straw, corn stalks or bean straw. Corn was chosen as the grain feed for all the lots.

Since the feeding of roots for fattening lambs at this station has been attended with good results in the past they were included in the ration of each lot. It is desirable and at times even necessary to use some clover hay and supplement this with other coarse fodders. Moreover, it has been believed by a large number of sheep men that, to secure the best results in caring for and fattening sheep, it is necessary to furnish considerable variety in food stuffs. It was thought therefore not only an interesting but important line of investigation to observe results where clover hay was fed in connection with other coarse fodders. Lambs will not eat any considerable quantity of other coarse fodders if they receive all the clover hay they want even if the clover hay is fed but once a day. Consequently the amount of clover hay fed in conjunction with the other fodders was limited as nearly as possible to half the amount fed to the standard pen or lot.

MANNER OF FEEDING.

The lambs were fed in the experimental feeding barn described on page 48 of bulletin No. 128. The feed troughs and racks were thoroughly cleaned out the first thing in the morning, and the lambs were fed their ration of corn about 6:30 a. m. As soon as the corn was eaten up the hay or other coarse fodder was put in the rack and fresh water provided. At 12:30 p. m., their allotted portion of roots was fed and at 4:00 p. m. corn, fodder and water were given in the same order as in the morning. During the ten days previous to the beginning of the experiment proper, the lambs were fed the same foods that they were to receive during the experiment and in the same manner; this period was designated as the preliminary feeding period. The lambs were weighed on three consecutive days at the beginning of the experiment and the average of these weights was taken as the true weight, thus largely doing away with the source of error in weight caused by differences in bowel contents.

FOOD STUFFS AND PRICES.

Somewhat peculiar conditions existed last winter in regard to the prices of food stuffs. Prices for corn ruled low while fodder of all kinds was high. The prices given below conform as nearly as may be to those current in this section of the State during the feeding period. The clover hay was of average quality. The roots were grown on the College farm and were rutabagas. The corn was yellow dent grown on the College farm. A portion of the millet hay used was also grown on the College farm and the remainder purchased of a farmer living near the College. The oat straw, corn stalks and bean straw were of average quality. It was found that the lambs wasted a large amount of corn stalks when they were fed in racks from the bundles. They were therefore cut in pieces from 1½ to 3 inches in length with an ordinary ensilage cutter.

Cost of Food Stuffs.

Corn, 30c for 56 lbs. or	$10 71	per ton.
Roots, (rutabagas)	2 50	" "
Clover hay	12 00	" "
Alfalfa	12 00	" "
Millet hay	10 00	" "
Oat straw	6 00	" "
Corn stalks	3 00	" "
Bean straw	7 00	" "

WEEKLY RECORDS OF FEED, WEIGHT AND GAIN.

These tables show the weight of lambs at the end of each week, the amount of the different foods consumed each week and the cost of these food stuffs. The amount of water drank is also shown. The totals at the bottom of the tables show at a glance the total food consumed during the feeding period. Each pen of lambs was weighed Monday mornings at 7:30 o'clock, water having been withheld about 14 hours previous to this time. The lambs were fed their corn before being weighed but no fodder.

EXPLANATION OF FINANCIAL STATEMENT.

The financial statement accompanying each lot is not altogether complete, as no account is there taken of the labor necessary to care for the lambs or of the valuable fertilizer produced in the form of sheep manure. With these exceptions, however, the financial statement is correct. The reader is cautioned to very carefully study the contents of this bulletin before drawing conclusions. Results shown in certain parts of this bulletin if taken alone might prove misleading, but by carefully studying the bulletin as a whole this source of error may be avoided.

LOT 1. (10 Lambs.)

Weekly record of feed, weight and gain. (Ration—Corn, roots and clover hay.)

Dates.	Weight of lambs. Pounds.	Corn. Pounds.	Roots. Pounds.	Hay. Pounds.	Water. Pounds.	Total cost of feed during week.	Total gain per week. Pounds	Cost of one pound of gain.	Average weekly temperature. °F
Nov. 11	752	....	....	....	....	....	......	....	......
" 18.	785	59	84	102.5	159	$1.036	33	$0.031	42.3
" 25.	812	73	88	106.5	169	1.152	27	.042	31.9
Dec. 2.	831	82	91	108.5	184	1.203	19	.063	32.5
" 9.	....	90	91	107	145	1.237	16	.077	24.4
" 16.	863	98	91	90	133	1.178	16	.073	25.2
" 23.	858	86.5	91	86	163	1.092	-5	....	51.8
" 30.	890	94	91	84	138	1.121	32	.035	40.2
Jan. 6.	907	106	91	83.5	106.75	1.182	17	.069	20.7
" 13.	937	107	89	74.5	124	1.131	30	.037	28.4
" 20.	954	105	91	73.5	134	1.117	17	.065	30.1
" 27.	980	111	73	72	145.75	1.117	26	.042	33.5
Feb. 3.	1,004	112	70	67.5	151.75	1.092	24	.045	36.1
" 10.	1,023	114	70	63	132.25	1.076	19	.056	33.0
" 17.	1,076	132	70	52	131.5	1.106	53	.020	26.2
Totals.	....	**1,369.5**	**1,181**	**1,172.5**	**2,017**	....	......	....	......

FINANCIAL STATEMENT.

Lot 1. (10 Lambs.)

To 10 lambs, 752 lbs. @ 2.37 cts.	$17.82
To feed as follows:	
1,369 5 lbs. shelled corn @ 30 cts. for 56 lbs., or $10.71 per ton	7.34
1,181 lbs. ruta bagas @ $2.50 per ton	1.47
1,172.5 lbs. clover hay @ $12.00 per ton	7.03
Total expenditures	$33.66
By 10 lambs, 1,076 lbs. @ $4.60 per cwt.	$49.50
Profit on each lamb	$1.58

LOT 2. (10 Lambs.)

Weekly record of feed, weight and gain. (Ration—Corn, roots and alfalfa.)

Dates.		Weight of lambs. Pounds.	Corn. Pounds.	Roots. Pounds.	Alfalfa. Pounds.	Water. Pounds.	Total cost of feed during week.	Total gain per week. Pounds	Cost of one pound of gain.
November	11	740							
"	18	763	59	84	117.25	186	$1.124	23	$0.048
"	25	776	73	75	126	218	1.240	13	.095
December	2	797	82	91	124	219.5	1.296	21	.061
"	9		83	91	124	182.5	1.302	29.5	.044
"	16	856	98	91	112	172.5	1.310	29.5	.044
"	23	858	84	91	108	180.5	1.211	2	.605
"	30	903	94	91	106	186.5	1.253	45	.027
January	6	923	106	91	96.5	145.5	1.260	20	.063
"	13	948	107	89	77.5	160.25	1.149	25	.045
"	20	978	105	91	74.5	156.25	1.123	30	.037
"	27	992	111	73	72	165.25	1.117	14	.079
February	3	1,016	111	70	54.5	157.25	1.008	24	.042
"	10	1,031	114	70	45.5	137.25	.971	15	.064
"	17	1,084	131	70	45	124.5	1.059	53	.020
Totals			1,358	1,168	1,282.75	2,381.75			

FINANCIAL STATEMENT.

Lot 2. (10 Lambs.)

To 10 lambs, 740 lbs. @ 2.37 cts.	$17.53
To feed as follows:	
1,358 lbs. shelled corn, @ 30 cts for 56 lbs., or $10.71 per ton	7.28
1,168 lbs. ruta bagas, @ 2.50 per ton	1.46
1,282.75 lbs. alfalfa, @ $12 per ton	7.69
Total expenditures	$33.96
By 10 lambs, 1,084 lbs. @ $4.60 per cwt.	$49.86
Profit on each lamb	$1.59

LOT 3. (10 Lambs.)

Weekly record of feed, weight and gain. (Ration—Corn, roots, clover hay and millet hay.)

Dates.	Weight of Lambs. Pounds.	Corn. Pounds.	Roots. Pounds.	Clover Hay. Pounds	Millet Hay. Pounds	Water. Pounds.	Total cost of feed during week.	Total gain per week. Pounds	Cost of one pound gain.
Nov. 11	748	----	----	----	----	----	----	----	----
" 18	779	59	84	58	42	134	$0.979	31	$0.031
" 25	795	73	88	56	49.5	162	1.084	16	.067
Dec. 2	808	82	91	56	49	170	1.133	13	.087
" 9	----	90	91	55	48	137	1.165	24	.048
" 16	856	98	91	46	45.5	131.5	1.141	24	.047
" 23	842	86.5	91	44	37.5	146	1.027	-14	----
" 30	882	94	91	42	42	144.75	1.079	40	.026
Jan. 6	902	106	91	41.5	42	117.25	1.140	20	.057
" 13	925	107	89	38.5	36	124.5	1.095	23	.047
" 20	946	105	91	38.5	35	137.25	1.082	21	.051
" 27	965	111	73	37	33	141.5	1.072	19	.056
Feb. 3	995	112	70	33.5	30.5	154.75	1.040	30	.034
" 10	1,021	114	70	31.5	28	144.75	1.027	26	.039
" 17	1,080	132	70	25.5	24	141.5	1.067	59	.018
Totals	--------	1,369.5	1,181	608.	542.	1,986.75	--------	------	--------

FINANCIAL STATEMENT.

Lot 3. (10 Lambs.)

To 10 lambs, 748 lbs. @ 2.37 cts.	$17.72
To feed as follows:	
1,369.5 lbs. shelled corn @ 30 cts. for 56 lbs. or $10.71 per ton	7.34
1,181 lbs. ruta bagas @ $2.50 per ton	1.47
608 lbs. clover hay @ $12.00 per ton	3.62
542 lbs. millet hay @ $10.00 per ton	2.71
Total expenditure	$32 86
By 10 lambs, 1,080 lbs. @ $4.60 per cwt.	$49.68
Profit on each lamb	$1.68

LOT 4. (10 Lambs.)

Weekly record of feed, weight and gain. (Ration—Corn, roots and millet hay.)

Dates.	Weight of lambs. Pounds.	Corn. Pounds.	Roots. Pounds.	Millet hay. Pounds.	Water. Pounds.	Total cost of feed during week.	Total gain per week. Pounds	Cost of one pound of gain.
November 11	729	--------	--------	--------	--------	--------	------	--------
" 18	746	59	84	94.25	116	$0.892	17	$0 052
" 25	770	73	75	107	136.5	1.019	24	.042
December 2	784	82	91	119	172	1.147	14	.081
" 9	--------	90	91	102.5	131.5	1.107	8.5	.130
" 16	801	96	91	81.0	144	1.032	8.5	.121
" 23	787	79	91	62.5	169.75	.848	-14	--------
" 30	824	93.5	91	56	131.75	.894	37	.024
January 6	847	106	91	63	98.75	.996	23	.043
" 13	875	107	89	49.5	114 25	.931	28	.033
" 20	895	105	91	52.5	143.75	.938	20	.046
" 27	917	111	73	51	135.5	.940	22	.042
February 3	941	112	70	46.5	135.75	.919	24	.038
" 10	971	114	70	42	134.25	.908	30	.030
" 17	987	123	70	32	105.5	.906	16	.056
Totals	--------	**1,350.5**	**1,168**	**958.75**	**1,869.25**	--------	------	--------

FINANCIAL STATEMENT.

Lot 4. (10 Lambs.)

To 10 lambs, 729 lbs. @ 2.37 cts.	$17.27
To feed as follows:	
1,350.5 lbs. shelled corn @ 30 cts. for 56 lbs. or $10.71 per ton	7.23
1,168 lbs. ruta bagas @ $2.50 per ton	1.46
958.75 lbs. millet hay @ $10.00 per ton	4.79
Total expenditures	$30.75
By 10 lambs, 987 lbs. @ $4.60 per cwt.	$45.40
Profit on each lamb	$1.46

LOT 5. (10 Lambs.)

Weekly record of feed, weight and gain. (Ration—Corn, roots, clover hay and oat straw.)

Dates.	Weight of lambs. Pounds.	Corn. Pounds.	Roots. Pounds.	Clover hay. Pounds	Oat straw. Pounds	Water. Pounds.	Total cost of feed during week.	Total gain per week. Pounds	Cost of one pound gain.
Nov. 11	734	----	----	----	----	----	----	----	----
" 18	771	59	84	58	42.5	139	$0.896	37	$0.024
" 25	792	73	75	56	52.5	148	.977	21	.046
Dec. 2	802	76	91	56	52.5	135	1.013	10	.101
" 9	----	90	91	55 5	52	127.5	1.084	17.5	.061
" 16	837	98	91	46	49	139	1.061	17.5	.060
" 23	832	86.5	91	44.5	49	152.25	.990	-5	----
" 30	869	94	91	42	52.5	143.75	1.026	37	.027
Jan. 6	888	106	91	41.5	52.5	107.75	1.087	19	.057
" 13	912	107	89	38.5	45.5	139.25	1.051	24	.043
" 20	927	105	91	38.5	44	134.5	1.039	15	.069
" 27	958	111	73	37	44.5	154	1.040	31	.033
Feb. 3	978	112	70	33.5	41	155.75	1.011	20	.050
" 10	1,003	114	70	31.5	38.5	144.5	1.002	25	.040
" 17	1,051	132	70	25.5	37.5	152	1.059	48	.022
Totals	----	1,363.5	1,168	604.0	653.5	1,972.25	----	----	----

FINANCIAL STATEMENT.

Lot 5. (10 Lambs.)

To 10 lambs, 734 lbs. @ 2.37 cts.	$17.39
To feed as follows:	
1,363.5 lbs. shelled corn @ 30 cts. for 56 lbs. or $10.71 per ton	7.30
1,168 lbs. ruta bagas, @ $2 50 per ton	1.46
604 lbs. clover hay, @ $12 per ton	3.62
653.5 lbs. oat straw, @ $6 per ton	1.96
Total expenditures	$31.73
By 10 lambs, 1,051 lbs., @ $4.60 per cwt.	$48.35
Profit on each lamb	$1.66

LOT 6. (10 Lambs.)

Weekly record of feed, weight and gain. (Ration—Corn, roots and oat straw.)

Dates.		Weight of lambs. Pounds.	Corn. Pounds.	Roots. Pounds.	Oat straw. Pounds.	Water. Pounds.	Total cost of feed during week.	Total gain per week. Pounds	Cost of one pound of gain.
Nov.	11	739	....	....	....	....	....	....	....
"	18	766	59	84	93	122	$0.700	27	$0.025
"	25	786	73	75	110	140	.814	20	.040
Dec.	2	792	76	91	122.5	140.5	.887	6	.147
"	9	....	90	91	120.5	131	.956	15.5	.061
"	16	823	98	91	108.5	125	.963	15.5	.062
"	23	820	86.5	91	106.5	160.5	.895	-3	....
"	30	855	94	91	105	154	.932	35	.026
Jan.	6	876	106	91	104.5	113	.994	21	.047
"	13	899	107	91	98	137	.980	23	.042
"	20	912	105	91	96	137.5	.964	13	.074
"	27	937	111	73	89.5	151.5	.953	25	.038
Feb.	3	961	112	70	83	157	.936	24	.039
"	10	985	114	70	80.5	154.5	.939	24	.039
"	17	1,024	132	70	76	141	1.022	39	.026
Totals		....	1,363.5	1,170	1,393.5	1,964.5	....	....	....

FINANCIAL STATEMENT.

Lot 6. (10 Lambs.)

To 10 lambs, 739 pounds @ 2.37 cts.	$17.514
To feed as follows:	
1,363.5 lbs. shelled corn @ 30 cts. for 56 lbs. or $10.71 per ton	7.308
1,170 lbs. ruta bagas @ $2.50 per ton	1.462
1,393.5 lbs. oat straw @ $6.00 per ton	4.18
Total expenditures	$30.464
By 10 lambs, 1,024 lbs. @ $4.60 per cwt.	$47.10
Profit on each lamb	$1.66

LOT 7. (10 Lambs.)

Weekly record of feed, weight and gain. (Ration—Corn, roots, clover hay and corn stalks.)

Dates.	Weight of lambs. Pounds.	Corn. Pounds.	Roots. Pounds.	Clover hay. Pounds	Corn stalks. Pounds.	Water. Pounds.	Total cost of feed during week.	Total gain per week. Pounds	Cost of one pound of gain.
Nov. 11	727	--------	--------	------	--------	--------	--------	------	--------
" 18	762	59	84	58	47.25	141	$0.839	35	$0.023
" 25	791	73	75	56	53	178	.899	29	.031
Dec. 2	801	76	91	56	52.5	149	.934	10	.093
" 9	--------	90	91	54.5	49	146	.995	19	.052
" 16	839	98	91	45	52	127.75	.986	19	.051
" 23	831	86.5	91	44	50.5	157.25	.915	-8	--------
" 30	864	94	91	42	49	135	.942	33	.028
Jan. 6	890	106	91	41.5	49	105.5	1.003	26	.038
" 13	906	107	89	38.5	45.5	117	.983	16	.061
" 20	937	105	91	38.5	45.5	128.25	.975	31	.031
" 27	966	111	73	37	44.5	132	.973	29	.033
Feb. 3	991	112	70	33.5	41	132.75	.949	25	.037
" 10	1,015	114	70	31.5	38.5	135	.944	24	.039
" 17	1,061	132	70	25.5	37.5	127.5	1.003	46	.021
Totals	--------	**1,363.5**	**1,168**	**601.5**	**654.75**	**1,912.0**	--------	------	--------

FINANCIAL STATEMENT.

Lot 7. (10 Lambs.)

To 10 lambs, 727 lbs. @ 2.37 cts.	$17.22
To feed as follows:	
1,363.5 lbs. shelled corn, @ 30 cts. for 56 lbs. or $10.71 per ton	7.30
1,168 lbs. ruta bagas, @ $2.50 per ton	1.46
601.5 lbs. clover hay, @ $12 per ton	3.61
654.75 lbs. corn stalks, @ $3 per ton	.98
Total expenditures	$30.57
By 10 lambs, 1,061 lbs., @ $4.60 per cwt.	$48.81
Profit on each lamb	$1.82

LOT 8. (10 Lambs.)

Weekly record of feed, weight and gain. (Ration—Corn, roots and corn stalks.)

Dates.	Weight of lambs. Pounds.	Corn. Pounds.	Roots. Pounds.	Corn stalks. Pounds.	Water. Pounds.	Total. cost of feed per week.	Total gain per week. Pounds	Cost of one pound gain.
Nov. 11	753							
" 18	766	59	84	103.5	114	$0.576	13	$0.044
" 25	789	73	75	121.5	147.5	.666	23	.028
Dec. 2	804	76	91	133	132	.719	15	.047
" 9		90	91	111.5	139.5	.762	19.5	.039
" 16	843	98	91	107.5	121	.799	19.5	.040
" 23	835	86.5	91	104.5	157.75	.732	-8	
" 30	871	94	91	105	156.5	.774	36	.021
Jan. 6	887	104	91	103.5	132	.825	16	.051
" 13	911	107	89	92	145.5	.822	24	.034
" 20	937	105	91	87.5	145	.807	26	.031
" 27	962	111	73	86	144.25	.814	25	.032
Feb. 3	987	112	70	83	141	.811	25	.032
" 10	1,009	114	70	80.5	159.75	.819	22	.037
" 17	1,055	133	70	76	154	.913	46	.019
Totals		**1,362.5**	**1,168**	**1,395**	**1,989.75**			

FINANCIAL STATEMENT.

Lot 8. (10 Lambs.)

To 10 lambs, 753 lbs. @ 2.37 cts.	$17.84
To feed as follows:	
1,362.5 lbs. shelled corn @ 30 cts. per 56 lbs. or $10.71 per ton	7.30
1,168 lbs. ruta bagas @ $2.50 per ton	1.46
1,395 lbs. corn stalks @ $3.00 per ton	2.09
Total expenditures	$28.69
By 10 lambs, 1,055 lbs. @ $4.60 per cwt.	$48.53
Profit on each lamb	$1.98

LOT 9. (10 Lambs.)

Weekly record of feed, weight and gain. (Ration—Corn, roots, clover hay and bean straw.

Dates.	Weight of lambs. Pounds.	Corn. Pounds.	Roots. Pounds.	Clover hay. Pounds	Bean straw. Pounds.	Water. Pounds.	Total cost of feed during week.	Total gain per week. Pounds	Cost of one pound gain.
Nov. 11	743								
" 18	772	59	84	58	50	148	$0.944	29	$0.032
" 25	800	73	75	56	57.5	175	1.021	28	.036
Dec. 2	801	70	91	56	56	193	1.020	1	1.020
" 9		90	91	55.5	56	187.5	1.124	30.5	.036
" 16	862	98	91	47.5	56	127.75	1.119	30.5	.036
" 23	847	86.5	91	44	52	150.25	1.022	-15	
" 30	883	94	91	42	49	129.5	1.040	36	.028
Jan. 6	909	106	91	41.5	49	117.5	1.101	26	.042
" 13	922	107	89	38.5	43	110.25	1.065	13	.081
" 20	953	105	91	38.5	42	127.5	1.054	31	.034
" 27	978	111	73	37	42	128.5	1,054	25	.042
Feb. 3	1,000	112	70	33.5	41	141.75	1.031	22	.046
" 10	1,021	114	70	31.5	38.5	144	1.022	21	.048
" 17	1,066	133	70	25.5	37.5	135.5	1.083	45	.024
Totals		**1,358.5**	**1,168**	**605**	**669.5**	**2,016**			

FINANCIAL STATEMENT.

Lot 9. (10 Lambs.)

To 10 lambs, 743 lbs., @ 2.37 cts.	$17.60
To feed as follows:	
1,358.5 lbs. shelled corn, @ 30 cts. for 56 lbs., or $10.71 per ton	7.28
1,168 lbs. ruta bagas, @ $2.50 per ton	1.46
605 lbs. clover hay, @ $12 per ton	3.63
669.5 lbs. bean straw, @ $7 per ton	2.34
Total expenditures	$32 31
By 10 lambs, 1,066 lbs., @ $4.60 per cwt.	$49.03
Profit on each lamb	$1.67

LOT 10. (10 Lambs.)

Weekly record of feed, weight and gain. (Ration—Corn, roots and bean straw.)

Dates.		Weight of lambs. Pounds.	Corn. Pounds.	Roots. Pounds.	Bean straw. Pounds.	Water. Pounds.	Total cost of feed during week.	Total gain per week. Pounds	Cost of one pound of gain.
Nov.	11	745	------	------	------	------	------	------	------
"	18	757	59	84	112.5	174	$0.815	12	$0.067
"	25	773	73	75	125	184	.921	16	.057
Dec.	2	791	82	91	119	183 5	.968	18	.053
"	9	------	90	91	112	169.25	.987	25	.039
"	16	841	98	91	118	141.5	1.051	25	.042
"	23	841	86.5	91	111.5	164.75	.966	-0	------
"	30	874	94	91	112	156.5	1.009	33	.030
Jan.	6	892	106	91	111.5	126	1.071	18	.059
"	13	907	107	89	96	140.5	1.020	15	.068
"	20	929	105	91	94.5	136.5	1.007	22	.045
"	27	957	111	73	88.5	163.25	.995	28	.035
Feb.	3	987	112	70	83	168.75	.977	30	.032
"	10	998	114	70	80.5	159.25	.980	11	.089
"	17	1,041	133	70	79	160	1.075	43	.025
Totals		------	1,370.5	1,168	1,443.0	2,227.75	------	------	------

FINANCIAL STATEMENT.

Lot 10. (10 Lambs.)

To 10 lambs, 745 lbs, @ 2 37 cts.	$17.65
To feed as follows:	
1,370.5 lbs, shelled corn @ 30 cts. for 56 lbs. or $10.71 per ton	7.34
1,168 lbs. ruta bagas @ $2 50 per ton	1.46
1,443 lbs bean straw @ $7.00 per ton	5.05
Total expenditures	$31.50
By 10 lambs, 1,041 lbs. @ $4.60 per cwt.	$47.88
Profit on each lamb	$1.63

TABLE I.—*Financial Summary.—Length of feeding period 14 weeks.*

Lot.	Distinguishing rations.	Average weight of lambs at the beginning of the feeding period.	Average weight of lambs at the end of the feeding period.	Cost of one pound gain.	Average total gain for each lamb for period.	Average cost of each lamb at beginning of the feeding period.	Average cost of feed for each lamb during the period.	Average price received for each lamb at the end of feeding period.	Average profit on each lamb for whole period.
1	Corn, roots and clover hay	75.2	107.6	$0.488	32.4	$1.782	$1.584	$4.949	$1.583
2	Corn, roots and alfalfa	74.0	108.4	0.477	34.4	1.758	1.642	4.986	1.590
3	Corn, roots, clover hay and millet hay	74.8	108.0	0.456	33.2	1.772	1.518	4.968	1.682
4	Corn, roots and millet hay	72.9	98.7	0.522	*25.8	1.727	1.347	4.540	1.464
5	Corn, roots, clover hay and oat straw	73.4	105.1	0.452	31.7	1.789	1.433	4.834	1.661
6	Corn, roots and oat straw	73.9	102.4	0.453	28.5	1.751	1.293	4.710	1.665
7	Corn, roots, clover hay and corn stalks	72.7	106.1	0.399	33.4	1.722	1.334	4.880	1.823
8	Corn, roots and corn stalks	75.3	105.5	0.358	30.2	1.789	1.083	4.858	1.984
9	Corn, roots, clover hay and bean straw	74.3	106.6	0.455	32.3	1.760	1.470	4.903	1.672
10	Corn, roots and bean straw	74.5	104.1	0.467	29.6	1.765	1.384	4.788	1.638

*This lot was troubled from time to time, especially during the early part of the feeding period with scours.

One of the important things for a sheep feeder to know is about how much it costs to grow or produce a pound of mutton. It is doubtful whether the average prices of food stuffs will rule higher during any one season than those current last winter, consequently where proper care is taken in feeding, the cost of a pound of gain should not exceed five cents.

The uniformity in weight of the lambs at the beginning of the experiment was of course a result of the careful assorting and other than to show that fact, the first column of figures is of no importance. On the other hand the great similarity in weight of the lambs at the end of the fattening period is very suggestive, fed as they were on such a variety of rations it clearly emphasizes the great importance of skill in feeding as well as the kind of food consumed in obtaining good results. This is still further shown by the average cost of feed for each lamb, average net profit on each lamb, total gain per lamb and cost of a pound of gain.

Perhaps the most significant fact exhibited by this table is that under the conditions obtaining in this experiment every lot with the exception f lot 4, fed millet hay, gave a greater average net profit than did the lot eceiving clover hay alone as the fodder ration. The lot showing the

highest average net profit was lot 8, fed corn stalks alone as the fodder ration, while lot 4 receiving millet hay gave the smallest net profit per lamb.

It is also of interest to note the similarity in the average gain of the lambs in lots 1, 2, 3, 5, 7, 8 and 9. The increased profit in case of corn stalks and some other fodders was not due therefore to greater gains but to smaller cost of food stuffs. While perhaps one ration may produce a pound of gain as economically as others it may yet be an inferior ration for fattening lambs because it fails to produce *large* gains. Any condition which would cause a change in price of food stuffs would greatly alter the results exhibited in this table.

TABLE II.—*Average weekly gain per lamb and average weekly temperature.*

Dates.	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Lot 8	Lot 9	Lot 10	Average weekly gain.	Average weekly temperature.
Nov. 11	----	----	----	----	----	----	----	----	----	----	----	----
" 18	3.3	2.3	3.1	1.7	3.7	2.7	3.5	1.3	2.9	1.2	2.57	42.3
" 25	2.7	1.3	1.6	2.4	2.1	2.0	2.9	2.3	2.8	1.6	2.17	31.9
Dec. 2	1.9	2.1	1.3	1.4	1.0	.6	1.0	1.5	.1	1.8	1.27	32.5
" 9	----	----	----	----	----	----	----	----	----	----	----	24.4
" 16	*3.2	5.9	4.8	1.7	3.5	3.1	3.8	3.9	6.1	5.0	4.01	25.2
" 23	-.5	.2	-1.4	-1.4	-.5	-.3	-.8	-.8	-1.5	0.0	-.70	51.8
" 30	3.2	4.5	4.0	3.7	3.7	3.5	3.3	3.6	3.6	3.3	3.64	40.2
Jan. 6	1.7	2.0	2.0	2.3	1.9	2.1	2.6	1.6	2.6	1.8	2.06	20.7
" 13	3.0	2.5	2.3	2.8	2.4	2.3	1.6	2.4	1.3	1.5	2.21	28.4
" 20	1.7	3.0	2.1	2.0	1.5	1.3	3.2	2.6	3.1	2.2	2.26	30.1
" 27	2.6	1.4	1.9	2.2	3.1	2.5	2.9	2.5	2.5	2.8	2.44	33.5
Feb. 3	2.4	2.4	3.0	2.4	2.0	2.4	2.5	2.5	2.2	3.0	2.48	36.1
" 10	1.9	1.5	2.6	3.0	2.5	2.4	2.4	2.2	2.1	1.1	2.17	33.0
" 17	5.3	5.3	5.9	1.6	4.8	3.9	4.6	4.6	4.5	4.3	4.48	26.2
Av. w'k'y gain	2.31	2.45	2.37	1.84	2.26	2.03	2.38	2.15	2.30	2.11	----	----

* Gain for two weeks.

The above table shows, the average gain per lamb by weeks for each lot, and both the average gain per lamb in each pen and the average gain by weeks throughout the whole period for all the lots, also the average weekly temperature. December 6 the lambs were dipped and owing to the unfavorable weather were still damp on Monday morning the 9th, which was the regular time for weighing, consequently it was thought best not to weigh until December 16, the gains recorded opposite that date are therefore for two weeks. The gains were quite uniform from week to week except in case of the week ending December 23, when there was a decided loss in all but two pens.

TABLE III.—*Summary of food consumed and dry matter.*

Lots.	Distinguishing rations.	Amount of corn fed during period.	Amount of roots fed during period.	Amount of fodder fed during period.	Amount of water drunk. Pounds.	Total amount of dry matter consumed. Pounds.	Pounds of dry matter to a pound of gain.
1	Corn, roots and clover hay	1,869.5	1,181	1,147.5	2,017	2,827.07	7.182
2	Corn, roots and alfalfa	1,858	1,168	1,228	2,881.75	2,462.18	7.157
3	Corn, roots, clover hay and millet hay	1,869.5	1,181	*600 †540.75	1,986.75	2,862.56	7.116
4	Corn, roots and millet hay	1,850.5	1,168	916	1,869.25	2,181.96	8.457
5	Corn, roots, clover hay oat straw	1,868.5	1,168	*602 ‡581.5	1,972 25	2,840 40	7.882
6	Corn, roots and oat straw	1,868.5	1,170	1,129.75	1,964.25	2,874.28	8.880
7	Corn, roots, clover hay and corn stalks	1,868.5	1,168	*586.5 ‖562.75	1,912	2,181.88	6.582
8	Corn, roots and corn stalks	1,862.5	1,168	1,159	1,989.75	2,041.86	6.758
9	Corn, roots, clover hay and bean straw	1,858.5	1,168	*608 §602.5	2,016	2,886.98	7.852
10	Corn, roots and bean straw	1,870.5	1,168	1,809 2	2,227.75	2,501 68	8.472

* Clover hay.
† Millet hay.
‡ Oat straw.
‖ Corn stalks.
§ Bean straw.

The amount of corn and roots fed to the various lots was practically the same though each lot was fed what they, in the judgment of the feeder, required. Where clover hay was fed with some other fodder it was fed at night and the other fodder in the morning. The total amount of clover hay fed in this way to lots 3, 5, 7 and 9 was within a very few pounds the same. Knowing these facts, comparisons between the different fodders become all the more valuable as no one can attribute the good results obtained to the increased amount of grain or roots fed to any particular lot.

Speaking in general terms the lambs drank an average of about two pounds of water each per day. The column showing the total amount of dry

matter eaten indicates the amount eaten as stated and not the amount fed as in some cases there was quite a little waste, especially with such fodders as corn stalks and oat straw. The results tabulated in the last column of the above table are important not only from a scientific but a practical standpoint. These figures give the number of pounds of dry matter required to produce a pound of gain. This datum is important for, while the net profit on lambs in the different lots depends upon the current prices of food stuffs, the dry matter required to produce a pound of gain would remain substantially the same from year to year. Only 6.76 pounds of dry matter were required to produce a pound of gain when corn stalks were used as fodder. This was the best showing made by any fodder used in the experiment. On the other hand fully a pound and one-half more of dry matter was necessary to produce a pound of gain in those lots which were fed millet hay and oat straw. In the remaining lots there was but little variation in this particular.

TABLE IV.—*Total protein, carbohydrates and fat.*

Lot.	Distinguishing rations.	Average weekly gain of each lamb.	Pounds of fodder fed to one pound gain.	Pounds of grain fed to one pound of gain.	Digestible protein fed per day per 1,000 pounds.	Digestible Carbohydrates fed per day per 1,000 pounds.	Digestible fat.	Nutritive ratio.
1	Corn, roots and clover hay	2.31	3.54	4.227	2.03	14.99	.87	1: 8.4
2	Corn, roots and alfalfa	2.45	3.55	3.947	2.28	15.61	.84	1: 7.9
3	Corn, roots, clover hay and millet hay	2.37	3.43	4.125	1.91	15.66	.88	1: 9.3
4	Corn, roots and millet hay	1.84	3.55	5.234	1.75	16.11	.81	1:10.4
5	Corn, roots, clover hay and oat straw	2.26	3.57	4.301	1.78	15.68	.83	1: 9.9
6	Corn, roots and oat straw	2.03	3.96	4.784	1.45	16.27	.78	1:12.6
7	Corn, roots, clover hay and corn stalks	2.38	3.44	4.082	1.78	15.18	.82	1: 9.7
8	Corn, roots and corn stalks	2.15	3.83	4.511	1.47	14.94	.75	1:11.4
9	Corn, roots, clover hay and bean straw	2.30	3.73	4.205	-------	--------	-----	--------
10	Corn, roots and bean straw	2.11	4.42	4.630	-------	--------	-----	--------

It is remarkable that the amount of fodder and grain fed to produce a pound of gain was so uniform in all the lots. In Table III it is shown that the total amount of corn and roots fed to each lot was practically the same, so that we are safe in concluding that the differences in results were due to the fodders in the ration rather than to the differences in the amount of grain fed. It might be thought that the variations would have been more marked had the proportion of fodder to grain been greater but there was not an excessive amount of grain fed as compared with the fodder, the relation existing between the two being practically what the appetites of the lambs demanded and the same as it has been in previous years.

TABLE V.—*Individual weights and gains of lambs.*

	Lot 1.										Lot 2.									
Ear tag of lambs	321	407	417	423	432	429	449	450	492	662	304	314	316	317	421	438	483	470	476	488
Weight at beginning of period	84	67	84	84	84	61	62	71	82	73	75	74	76	69	82	80	62	83	68	71
Weight at end of period	120	96	118	113	115	86	90	101	113	124	112	102	124	100	120	116	92	116	104	98
Total gain of each lamb	36	29	34	29	31	25	28	30	31	51	37	28	48	31	3[illegible]	36	30	33	36	27
	Lot 3.										Lot 4.									
Ear tag of lambs	306	327	415	420	439	461	465	473	487	491	303	307	409	410	312	331	324	478	493	495
Weight at beginning of period	73	95	81	61	79	64	79	70	82	64	78	77	69	73	72	76	73	57	74	80
Weight at end of period	111	136	121	85	113	88	105	102	121	98	102	89	87	114	92	113	98	76	102	114
Total gain of each lamb	38	41	40	24	34	24	26	32	39	34	21	12	18	41	20	37	25	19	28	34
	Lot 5.										Lot 6.									
Ear tag of lambs	310	328	411	414	418	426	427	463	475	482	319	32[illegible]	330	413	430	433	412	437	467	484
Weight at beginning of period	77	65	90	68	82	78	68	58	70	78	70	66	75	72	81	79	77	80	60	79
Weight at end of period	114	91	129	107	104	106	106	83	95	116	96	97	90	110	115	110	114	105	85	102
Total gain of each lamb	37	26	39	39	22	28	38	25	25	38	26	31	15	38	34	31	37	25	25	23

TABLE V.—*Continued.*

	Lot 7.										Lot 8.									
Ear tag of lambs	318	322	323	329	451	469	474	481	486	485	309	313	315	406	422	448	419	468	496	408
Weight at beginning of period	78	83	77	79	58	55	70	79	66	82	68	69	100	72	84	59	82	81	73	65
Weight at end of period	108	107	112	96	100	93	102	110	108	125	139	105	104	87	112	95	112	108	8	85
Total gain of each lamb	30	24	35	17	42	38	32	31	42	43	71	36	4	15	28	36	30	27	35	20
	Lot 9.										Lot 10.									
Ear tag of lambs	311	325	332	416	425	434	436	458	460	479	424	431	435	447	457	464	477	480	678	494
Weight at beginning of period	67	80	65	89	90	73	76	51	76	76	77	90	76	64	70	68	85	65	73	77
Weight at end of period	108	107	94	121	120	100	118	76	116	106	102	126	110	93	100	98	122	80	110	100
Total gain of each lamb	41	27	29	32	30	27	42	25	40	30	25	36	34	29	30	30	37	15	37	23

The above table shows the weight of each lamb in each lot at the beginning and at the end of the experiment and is given to exhibit the variation in gains made by different lambs on the same feed. It emphasizes the great importance to be attached to having lambs in different lots of equal thrift. Also that the different lots should contain as many lambs as possible to partially do away with the chances for error in results due to individual differences in lambs.

TABLE VI.—*Waste of different fodders in pounds during whole period.*

Lot	1	2	3	4	5	6	7	8	9	10
Clover hay	27	----	8	----	2	----	15	----	2	----
Alfalfa	----	59.75	----	----	----	----	----	----	----	----
Millet hay	----	----	4	42.75	----	----	----	----	----	----
Oat straw	----	----	----	----	132	244	----	----	----	----
Corn stalks	----	----	----	----	----	----	92	215	----	----
Bean straw	----	----	----	----	----	----	----	----	67	83.75

FEEDING CORN SMUT TO DAIRY COWS.

BY CLINTON D. SMITH.

Bulletin No. 137.—Farm Department.

Prof. C. F. Wheeler, the botanist of the station, reports as follows concerning the life history of corn smut and precautions to be observed to avoid its farther extension:

"*Life History.*—In an address delivered before the Agricultural Club at Berlin, Germany, February 11, 1888, Dr. Oscar Brefeld first gave to the world the true life history of corn smut. For twelve years he had experimented with the greatest care, both in the field and in the laboratory, to learn the actual behavior of the smuts of cereals.

It had been proven before this time that the smuts of wheat, barley and oats enter the sprouting grain when the young stem is less than one-quarter of an inch in length and grow upwards with the growth of the stem until the grains in the head are formed, when they at once seize upon this storehouse of prepared food, appropriating it to their own use. Until 1887 it was supposed that corn smut followed the same course of development.

The crowning glory of Brefeld's discovery is in proving that corn smut may infect the plants at any time before their full maturity, and moreover that the ripened smut spores themselves do not directly, by falling upon the corn plants, produce the disease.

The black dusty masses of ripened smut boils contain multitudes of dark brown spores well protected with thick walls, making them capable of resisting extremes of temperature and moisture and retaining their germinating power for a number of years.

These spores were found by Brefeld to germinate readily outside and away from corn plants whenever placed in moist fresh manure. He also found that they would not germinate readily in pure water, but that in manure water the spores germinate rapidly, forming a multitude of short branches which produced secondary spores in great numbers. These secondary spores are formed in the air, on the surface of water, also beneath it, and are easily carried by winds to fields, falling upon all parts of corn plants. Dew and rain carry these small spores inside the leaf sheaths and the husks of the ears, where they at once send out germ tubes that enter the plants, producing a local disease (the well

known smut boils) near the place of infection. In two or three weeks after the infection the characteristic smut boils appear.

This disease has been known since the discovery of America and has followed the introduction of corn raising into all parts of the globe.

The loss to the corn crop is rarely a serious one, in ordinary years, not averaging over two per cent.

Prevention.—No remedy for corn smut is known. From the above account of its life history it is evident that it is useless to treat the seed previous to planting. No doubt fungicides sprayed upon the growing corn might check the disease, but this treatment is not practicable.

Certain precautions may lessen the disease, for instance, cutting out and destroying smutted parts before the spores ripen and the use of chemical fertilizers and well rotted manure with a reasonable rotation of crops. The use of manure from stock fed with silage of smutted corn certainly tends to increase the liability to infection in fields to which such manure is applied. Our knowledge of the manner in which the disease is carried from field to field is wanting."

The Feeding Experiment.

The unusual prevalence of smut in the College corn fields in the fall of 1895 furnished the material for an experiment to test the effect of feeding corn smut both in moderate and excessive quantities to dairy cows.

The smut was gathered after the corn was cut and no attempt was made to entirely separate the husks and small abortive ears from the actual smut boils. Many masses of smut fell to the ground and brought away with them small quantities of sand. The figures given in the tables below, therefore, indicate not the exact amount of smut consumed, since with the smut there was a small but uncertain per cent of sand, husks and small pieces of leaves and abortive ears. The smut was drawn to the barn as fast as gathered and stored in bulk. It suffered no apparent fermentation or change of any kind before it was fed.

The smut was given to the cows mixed with their grain ration, which consisted of corn, four parts; wheat bran, three parts; ground oats, two parts, and oil meal, one part.

The rough feed consisted of corn stalks cut into inch lengths and a small ration of hay, never exceeding six pounds per day, thus compelling the cows to derive the principal part of their nourishment from the corn stalks and the smut and grain ration.

The four cows used in the experiment were grades, apparently vigorous and healthy, purchased in the vicinity of the College. The essential facts in regard to them are as follows:

TABLE I.

Name.	Breed.	Age, years.	Due to calve.
Materna	Shorthorn	9	Feb. 5, 1896.
Milla	"	7	Dec. 5, 1895.
Hebe	"	5?	Feb. 15, 1896.
Halo	Jersey	7	Aug. 1, 1895.

The experiment began November 6, 1895.

Materna and Milla, the former six months in calf at the beginning of the experiment and the latter due to calve early in its progress, were fed corn smut in as large doses as they could be induced to receive it.

Halo fresh in milk, and Hebe six months in calf at the beginning of the experiment received the smut in moderate doses only.

To each of the two cows, Hebe and Halo, two ounces of smut were given daily from the 7th to the 12th of November. On the 12th this quantity was doubled, each cow receiving four ounces. On the 13th the ration of smut was again doubled and each cow was given one-half pound. This quantity was again increased on the 15th to twelve ounces and finally on the 17th to one pound per day.

A pound of smut in the condition existing at the time of the experiment would fill a two-quart measure.

For Materna and Milla on the other hand the dose was very rapidly increased from two ounces per day, on the 7th and 8th of November, to four ounces on the 9th and 10th, six ounces on the 11th and 12th, twelve ounces on the 13th and 14th, one pound and a quarter on the 15th and 16th, one pound and three-fourths on the 17th and 18th and finally two pounds per day of the smut each, from the 19th of November to the 12th of December inclusive. In order to test the matter fully the amount given these cows was very rapidly increased after the 13th of December. On that day they each received three pounds of smut, on the 14th four pounds, on the 15th five pounds, on the 16th six pounds, on the 17th seven pounds, on the 18th ten pounds, and finally on the 19th eleven pounds, when the experiment closed.

Ten pounds of smut shovelled into a half bushel measure filled it. It is evident that the cows received in this daily ration more smut than they could possibly get in foraging over a corn field after the removal of the crop or in the stables in the winter when fed exclusively upon corn stalks as the roughage of the ration.

At the beginning of the experiment the cows ate the smut with great avidity, and the two cows, Hebe and Halo, who received it in moderate quantities only, continued to prefer it to their grain feed up to the close of the experiment. The two cows who received it in immoderately large quantities, on the other hand, manifested a less liking for it, as the quantity was increased, although they did not reject it up to the very last day of the experiment.

No change in appearance was noticed in the dung until the 22d of November, when it was observed to be distinctly darker than that of other cows in the stable fed a similar ration of grain and fodder without the smut. In consistency it was somewhat harder than normal and possibly in the cases of Materna and Milla, somewhat scantier.

Except in the case of Milla, who dropped her calf on the 5th of December, the weights of the cows for the most part gradually increased. Certainly no ill effect was noticed which could be ascribed to the feeding of corn smut.

An examination of Table III reveals no variations in temperature that could be ascribed to the corn smut. The low temperature of Materna on November 8 was due to her having been exposed to a cold rain storm for a couple of hours previous to the taking of the temperature. The temperature of Milla dropped suddenly just prior to her calving.

The following table gives the weights of the cows by weeks beginning with the 12th of November and ending with Christmas.

TABLE II.—*Weights of the cows by weeks.*

Date.	Materna.	Milla.	Hebe.	Halo.
	lbs.	lbs.	lbs.	lbs
November 5	930	1,046	922	754
" 12	994	1,074	992	742
" 19	960	1,068	960	744
" 26	1,007	1,083	991	793
December 3	990	1,114	1,004	785
" 10	1,000	975	1,018	768
" 17	1,072	912	1,022	778
" 24	1,007	875	1,016	787

The temperature of each cow was taken at the same hour three times per week. In the following table these temperatures are arranged in order.

TABLE III.—*Temperatures of the four cows on alternate days.*

Date.	Halo.	Hebe.	Materna	Milla.
November 6	101.4	102.4	103.	103.4
" 8	101.8	101.4	98.	103.6
" 9	101.	100.8	101.4	103.8
" 11	101.7	101.8	102.	103.2
" 13	......	101.8	102.1	103.5
" 15	101.2	101.1	101.4	102.4
" 18	101.	101.5	101.	102.1
" 20	101.8	102.	102.	103.4
" 22	101.2	102.1	101.8	103.
" 25	101.6	102.3	102.4	103.4
" 27	101.8	102.	102.2	103.4
" 29	101.7	101.9	102.9	103.4
December 2	101.5	102.2	103.4	103.9
" 4	102.	102.5	102.	101.9
" 6	102.8	102.4	102.5	101.8
" 10	101.6	102.	102.	102.
" 12	102.	102.	103.4	102.
" 14	102.1	101.9	102.8	101.6
" 16	101.4	101.8	102.5	101.5
" 19	101.6	101.8	102.1	103.
" 21	101.3	100.6	102.	102.7
" 23	101.6	101.4	101.4	101.4
" 26	101.4	102.3	103.8	101.4

The pregnant cows were watched for signs of abortion, but none appeared.

Their milk yield was regular and constant, in the case of the cows giving milk, and no indication was given of any variation in this respect from normal conditions.

On the very last day of the experiment, five pounds of the corn smut were given in the morning and six pounds at night to Materna and Milla.

The following morning it was found that the night feed had not been entirely eaten up, approximately three-fourths of a pound of the mixed grain and smut being left in each manger. Their appetite for smut seemed to have been completely satisfied for the first time during the experiment.

On December 20, four pounds of smut were again fed these cows, mixed as usual with their grain feed. While the cows did not absolutely refuse the mixture, they ate it with very evident reluctance. The bowels of Milla were loose from the heavy feeding of the day previous and the cow seemed decidedly indisposed. Her temperature rose to 103° on the evening of December 19, the day on which she received the eleven pounds of smut.

The behavior of the two cows, Materna and Milla, was watched for a week thereafter. They continued in good health and gave no signs of any abnormal condition of the bowels. Their dung gradually lost the dark color and the cows then became in every way normal.

Samples of the corn smut were placed in the hands of the chemist for analysis, with the following results:

Composition of Corn Smut.

Moisture	8.30	per cent.
Albuminoids	13.06	" "
Carbohydrates	25.60	" "
Cellulose	24.69	" "
Sugar	4.00	" "
Fat	1.35	" "
Ash—much sand	22.50	" "

Dr. R. C. Kedzie, the chemist of the station, in commenting on this analysis, says "that the ash was rich in the phosphates of potash and magnesium like the ash of grain, but a large part of the ash was sand accidently present from contact of the smut with the ground while gathering."

"The smut was carefully examined for poisonous alkaloids to see whether the alleged poisonous properties of the smut could be explained by the presence of any organic poison, but not a trace could be detected, although a large quantity (twenty grams) was used for this purpose.

"It is surprising to see the avidity with which cattle will eat the corn smut and it seems difficult to explain their appetite for so repulsive a material. Perhaps the presence of sugar (four per cent) in the smut may explain this, for the reason that cattle are very fond of sugar."

The conclusion which can be safely drawn from this experiment is, that where cows are gradually brought into the habit of consuming large quantities of smut it does not seem hurtful to them. Whether the same thing would be true where cows unaccustomed to smut suddenly gain access to large quantities of it must remain for future experiment. It is safe to say, however, that any quantity of smut that would be at all likely to exist in a cornfield or on the stalks as fed under normal conditions to the cows of the farmer, would not be dangerous to the health of the animals.

In 1868, Prof. John Gamgee, in investigating the "corn stalk disease," fed experimentally forty pounds of corn smut to two cows, beginning

with six and increasing to twelve ounces daily. The smut was fed with ground grain and chopped hay. To one cow it was given wet, to the other dry. The cow that received the wet ration gained in weight during the trial, the other lost in weight, but both remained well.

Dr. N. S. Mayo, in discussing the relation of corn smut to "the corn stalk disease of cattle," in Bulletin No. 58 of the Kansas Experiment Station, records the experience of a farmer living near Manhattan who, believing that corn smut was liable to produce the disease, took pains to gather the smut from the field. "One night his cattle broke into the enclosure where the smutty corn and smut had been thrown out and ate all they wished; no injurious effects were noticed."

In Bulletin No. 10, U. S. Department of Agriculture, Bureau of Animal Industry, there is recorded the results of an experiment performed in January, 1894, of feeding corn smut in large quantities to two heifers. The results are reported as follows:

"Beginning on the morning of January 17, 1894, and continuing until noon of February 2 (sixteen and one-half days), the heifers were fed morning and evening with from two to three quarts of a mixture of equal parts by weight of cut hay and a mixture of corn meal, middlings and wheat bran, and sixteen quarts of smut. The actual quantity of the fungus consumed by one heifer was sixty-one pounds or a daily average of nearly three and seven-tenths pounds, and by the others sixty-seven and one-half pounds, or a daily average of four and one-fifth pounds. The temperatures of the animals were taken every morning and evening. The animals appeared to be perfectly well throughout the time of feeding and continued so for several months, during which time they were kept under close observation."

The results of our experiment coincide with those of other experiments whose records are available and may be taken as showing that no danger is to be apprehended from the feeding of smutty stalks, either to pregnant dairy cows or to those in full milk. It is unquestionably true that the feeding of smutty stalks and corn perpetuates the disease from year to year through the medium of the manure. It is otherwise good management to haul manure directly from the stable to the fields, usually in sod, on which the corn is to be planted the following year, although such a course, while economizing the human labor in the care of the cows, brings about the best possible conditions for infecting the corn crop. No statistics are at hand to show that the corn smut is more prevalent in recent years than heretofore, although the practice of hauling out manure as fast as it is made has been common for many years.

To prevent the spread of the disease it may be expedient to remove the growing smut boils before the spores mature, but the expense of going through the corn field as often as would be necessary to accomplish this purpose would be so great as to render the method out of the question for the ordinary farmer. After the dark brown masses of spores have become ripe and dry, but little advantage can result from cutting them off and leaving then in the corn field where they would be blown about by the winds.

PIG FEEDING.

BY CLINTON D. SMITH.

Bulletin No. 138.—Farm Department.

I. Gains Before and After Weaning.

The object of this feeding experiment was to afford additional data in answer to the question whether the gains made by young pigs before weaning were put on at a greater or less cost per pound than when the pigs were older.

The sows and pigs before weaning and the pigs thereafter were fed on a ration of skim milk and a grain mixture of one part corn meal and two parts middlings. The supply of skim milk varied from week to week and no constant relation between the quantity of grain ration and of skim milk was maintained.

The pigs were encouraged to eat in the trough with their dams as early as possible. When, therefore, they came to weaning, they were already in the habit of eating from a trough and the change from the milk of the dam to the new ration was neither sudden nor extreme.

Two sows and litters were used in the test.

One of them was a registered Duroc Jersey, four years old, and with her fourth litter. She had by her side at the beginning of the experiment eight pigs apparently even in growth, sound and thrifty. They were farrowed March 20.

The other sow was a registered Poland China with nine pigs, her second litter. These pigs were farrowed April 6. The pigs in both litters were marked and numbered by ear tags. Their weights were taken weekly from the 13th of April, when the experiment began, until the 10th of August. These weights are recorded in the following table to illustrate the variations in growth between individual pigs from week to week.

These weekly weights are combined in Table II and the weights of the sows while running with the pigs are also given.

TABLE I.—*Weights of pig*.

Date.	Duroc Jersey Pigs.								Poland China Pi s.								
	1		3	4	5	6	7	8	1	2	3		5	6	7	8	9
April 13	12.5	13.25	10.5	12.5	8.75	13.	7.75	12.25	8.75	3.63	3.38	5.25	4.5	4.5	5.	3.	5.5
" 20	17.25	18.5	15.75	16.5	12.25	17.75	10.5	17.5	6.25	6.25	8.75	7.75	7.5	6.25	8.35	4.75	7.75
" 27	22.25	21.75	19.25	20.5	18.	23.25	14.25	22.	7.25	7.5	10.	9.25	9.	7.5	10.5	6.5	9.
May 4	29.25	28.	25.12	27.25	17.25	29.75	18.25	28.	10.75	10.25	13.	13.	13.	10.	14.5	9.25	12.25
" 11	36.5	35.	31.	35.	24.5	36.75	25.25	34.5	14.5	13.5	16.5	17.	17.5	15.	19.5	14.	17.
" 18	42.	39.5	34.	41.5	29.	42.25	29.5	39.5	19.75	17.5	20.5	22.	22.	19.25	25.	18.5	21.75
" 25	48.5	50.	45.5	50.5	35.	49.	36.5	50	25.5	20.5	26.5	26.	27.	25.	31.5	23.5	28.
June 1	55.5	55.5	49.	59	40.	59.5	45.5	56.	29.5	27.	30.	32	30.5	31.	38.5	28.5	32.
" 8	64.5	61.5	56.5	62.	49.	61.5	48.5	58.5	33.	30.	34.5	37.5	38.5	34.5	41.5	33.5	36.5
" 15	68.	63.	62.	67.5	50.5	63.5	53.	74	38.	37.	40.	43.5	41.5	40.	48.	39.	41.
" 22	83.	73.	72.	78.	56.5	74.5	63.	74.	44.5	42.5	49.	53.5	49.	45.	57.	46.5	47.5
" 29	88.	81.	78.	88.5	66.	79.	61.	79.	47.	51.	52.	56.	51.	53.	6[illegible]	52.	53.
July 6	100.	76.	85.	92.	69.	85	75.	83.	56.	54.	55.	59.	58.	58.	71.	59.	61.
" 13	101.	80.	83.	94.	78.	86.	75.	88.5	59.	57.	59.	64.	58.	65.5	72.	60.	63.5
" 20	114.	98.5	100.	104.	83.	110.	88	83.5	63.5	64.5	67.	70.5	68.	69.	78.	73.	69.
" 27	122.	105.	105.5	112.	91.	93.	86.	103.	68.5	68.5	71.5	79.	73.5	75.5	84.5	77.	76.5
Aug. 3	130.5	111.	111.5	117.	92.5	108.	93.5	107.5	74.5	76.5	89.5	85.	75.	80.5	82.	84.	91.
" 10	137.5	111.5	118.5	117.	101.	123.5	102.	116	83.	81.5	86.5	91.5	82.5	88.5	95.	90.5	91.5
Total gain	125.0	98.25	108.0	104.5	92.25	110.5	94.25	103.75	79.25	77.87	83.12	86.25	78.0	84.0	90.0	87.5	86.0
Weekly gain	7.35	5.77	6.35	6.14	5.49	6.5	5.54	6.10	4.68	4.58	4.89	5.07	4.58	4.94	5.30	5.14	5.06

TABLE II.—*Weights of sows and litters.*

Date.	Duroc Jersey. Weight of sow. Lbs.	Duroc Jersey. Weight of pigs. Lbs.	Duroc Jersey. Gain of pigs. Lbs.	Poland China. Weight of sow. Lbs.	Poland China. Weight of pigs. Lbs.	Poland China. Gain of pigs. Lbs.
April 13	420.	90.5	....	294.5	41.25	....
" 20	448.5	126.0	35.5	311.0	63.5	22.25
" 27	436.0	155.5	29.5	311.5	76.5	13.0
May 4	454.0	202.9	47.4	299.0	105.0	28.5
" 11	437.0	258.5	55.6	285.0	144.5	39.5
" 18	423.0	297.25	38.75	286.5	186.25	41.75
" 25	....	365.0	67.75	299.0	233.5	47.25
June 1	....	420.0	55.0	....	279.0	45.5
" 8	....	458.0	38.0	....	319.5	40.5
" 15	....	493.0	35.0	....	368.0	48.5
" 22	....	575.0	82.0	....	435.5	67.5
" 29	....	633.5	58.5	....	478.0	42.5
July 6	....	676.0	42.5	....	527.0	49.0
" 13	....	709.0	33.0	....	558.0	31.0
" 20	....	781.0	72.0	....	622.5	64.5
" 27	....	823.5	42.5	....	674.5	52.0
August 3	....	871.5	48.0	....	728.0	53.5
" 10	....	927.0	55.5	....	789.5	61.5
Total gain			536.5	Total gain		748.2

The Duroc Jersey pigs were weaned during the week ending May 18, and the Poland China during the week ending May 25. The former were fifty-nine days old when weaned and the latter forty-nine. The sows were removed from the pigs for longer periods on consecutive days and gradually dried off. The amount of milk required to support eight or nine thrifty, vigorous and rapidly growing pigs is by no means small and for the sake of the udder of the sow and the good of the young pigs the weaning was carefully done. Sows should be selected not alone for their forms and prolificacy, their milk-giving qualities should also be considered. Before the birth of the pigs the sows should be fed not to fatten them with a ration of corn alone, but to develop good, strong, healthy pigs. This may be best done by allowing plenty of exercise in the open field and by feeding a variety of foods. The sows in this case had been fed on practically the same ration before the birth of the pigs that they received afterwards, and as a necessary consequence the pigs came healthy and able to take care of themselves. There were no weaklings in either litter. Moreover, the continuance of the feed after the birth of the pigs to which the sows were accustomed before, rendered unnecessary any sudden and extreme change of feed at that critical time. Naturally the sows were fed sparingly for a few days, both before and after the pigs came, to prevent congestion of the udder.

Among the Duroc pigs the one that made the greatest total gain was one of the larger pigs on the start. On the other hand, pigs number five and seven were the smallest pigs in the litter when first weighed and remained the smallest throughout, making the lightest gains.

The Poland China litter was very even both on the start and in their after growth, although pigs number seven, four and nine were the heaviest at the beginning and remained so to the end of the test.

The record of the feeding of the Duroc pigs extends back but four weeks before weaning. In the next table there is given the gains of the sows and pigs for the four weeks before weaning, the feed eaten, the dry matter in the feed and the amounts of the different constituents of the feed required to produce a hundred pounds of gain. For comparison the same facts are given for the four weeks immediately following weaning and finally for the last four weeks of the feeding period, ending August 10.

In computing the cost of the gain, the values of the feeding stuffs in the Lansing markets are used, viz.: Corn meal, 45 cents per hundred; middlings, 50 cents per hundred, and skim milk 20 cents per hundred.

TABLE III.—*Comparison of gains and food consumption before and after weaning.*

Period.	Gains.	Total food eaten.			Total dry matter.	Dry matter per 1 lb. gain.	Required for 100 lbs. gain.			
		Corn.	Middlings.	Milk.			Corn.	Middlings.	Milk.	Cost.
Duroc Jersey:										
Before	185.0	93.69	187.37	1,817.5	422.64	2.28	50.6	101.2	982.4	$2 69
After	195.8	126.58	253.16	1,845.5	512.78	2.62	64.6	129.3	942.5	2 82
Last	218.08	242.33	484.66	1,480.0	784.00	3.60	111.2	222.4	678.9	2 97
Poland China:										
Before	98.25	80.33	160.66	1,196.0	327.62	3.33	81.8	163.6	1,217.2	$3 62
After	202.0	101.82	203.65	1,574.0	420.83	2.08	50.4	100.8	779.2	2 29
Last	231.5	214.99	429.98	1,255.0	689.99	2.98	92.9	185.8	542.1	2 42
Averages		Before weaning				2.80				$3 15
		After weaning				2.35				2 55
		Last four weeks				3.29				2 69

Both sows lost heavily in weight during the four weeks immediately preceding the weaning of the pigs. The Duroc Jersey lost 11.5 pounds, and the Poland China 25 pounds. This extra shrinkage on the part of the latter sow very largely accounts for the increased cost of production of the gains in the four weeks preceding weaning. The pigs gained 122.8 pounds in these four weeks and disregarding the loss of weight by the sow, they made a pound of gain from 2.66 pounds of dry matter and at a cost of but $2.80 per hundred.

The fluctuations in the weights of the sows were great, owing undoubtedly largely to variations in bowel contents. They were exceedingly voracious and it was impossible to so control them before weighing as to get the conditions exactly alike each time. Moreover, it is in the natural order of things that the fat stored up in their bodies while pregnant should be utilized to furnish nourishment to the young pigs, resulting in a rapid loss of weight.

Taking all these facts into consideration the results of the test warrant the conclusion that *it costs but little more to make growth on pigs before weaning than afterwards.*

Professor Henry, at the Wisconsin Experiment Station, performed several experiments on the same point. From his work the following table is taken (Seventh An. Rept. Wisconsin Station, page 51):

TABLE IV.—*Showing the amount and cost of food required for 100 pounds gain.*

Lots.	Sows and pigs before weaning.				Pigs after weaning.			
	Corn.	Milk.	Shorts.	Cost.	Corn.	Milk.	Shorts.	Cost.
Lot II	184	482	....	$1 79	187	562	....	$1 96
" III	116	....	232	1 68	115	....	230	1 67
Average	....	....	....	$1.735	....	....	....	$1.815

For the sake of comparison with our results above, the cost of the gains have been computed on the same basis, viz.: Corn at 45 cents per hundred, shorts or middlings at 50 cents and milk at 20 cents per hundred.

For farther study the results of four other trials at the same station are given in the next table, taken from the same report, page 52.

TABLE V.—*Showing the amount and cost of feed for 100 pounds gain.*

Lots.	Sows and pigs before weaning.			Pigs after weaning.		
	Meal.	Milk.	Cost.	Meal.	Milk.	Cost.
Lot I	241	561	$2 26	251	587	$2 36
" II	288	649	2 66	215	577	2 17
" III	198	654	2 25	313	449	1 91
" IV	240	528	2 19	177	542	1 92
Average	248	598	$2 34	214	539	$2 09

Commenting on these two tables Professor Henry says: "It will be seen that this year (Table IV) we produced gain somewhat cheaper while the pigs were with the sow than after they were weaned, while last year the reverse was the case. Averaging the trials for the two years we have a difference so small that it may be entirely set aside by the results of further investigations."

In the following table is set forth by weeks the amount of each food constituent of the ration consumed by each litter of pigs, the total dry matter consumed, gain of pigs and pounds of dry matter consumed per pound of gain:

TABLE VI.—*Duroc Jersey, 8 pigs; pigs weaned May 18th.*

Week ending	Corn meal. Lbs.	Mid-dlings. Lbs.	Skim milk. Lbs.	Total dry matter. Lbs.	Gain. Lbs.	Dry matter per 1 lb. gain.
April 20	27.69	55.38	455.5	117.07	35.5	3.29
" 27	17.00	34.00	553.0	78.93	29.5	2.66
May 4	24.50	49.00	484.0	111.35	47.4	2.34
" 11	24.50	49.00	525.0	115.29	55.6	2.07
" 18, sow	13.75	27.50	264.5	61.81	....	....
" 18, pigs	12.41	24.83	337.0	65.24	38.75	1.68
" 25	28.58	57.16	517.5	125.38	67.75	1.85
June 1	31.50	63.00	510.0	132.41	55.0	2.40
" 8	31.5	63.00	418.0	123.88	38.00	3.26
" 15	35.00	70.00	400.0	131.11	35.0	3.74
" 22	37.33	74.66	520.0	148.81	82.0	1.81
" 29	42.00	84.00	570.0	165.98	58.5	2.83
July 6	39.33	78.66	485.9	150.75	42.5	3.54
" 13	41.85	83.70	425.0	151.66	33.0	4.59
" 20	49.00	98.00	400.0	168.20	72.0	2.33
" 27	60.00	120.00	390.0	196.38	42.5	4.62
August 3	63.33	126.66	360.0	202.82	48.0	4.21
" 10	70.00	140.00	330.0	217.11	55.5	3.91

The next table records the corresponding facts for the Poland China pigs.

TABLE VII.—*Poland China, 9 pigs; pigs weaned May 25th.*

Week ending	Corn meal. Lbs.	Mid-dlings. Lbs.	Skim milk. Lbs.	Total dry matter. Lbs.	Gain. Lbs.	Dry matter per 1 lb. gain.
April 20	26.87	53.74	539.5	122.97	22.25	5.53
" 27	17.00	34.00	241.0	68.18	13.00	5.24
May 4	21.00	42.00	252.0	79.82	28.50	2.80
" 11	21.00	42.00	315.0	85.87	39.5	2.17
" 18	21.33	42.66	388.0	93.75	41.75	2.24
" 25, sow	13.33	26.66	249.0	59.21	....	....
" 25, pigs	15.42	30.84	289.5	68.59	47.25	1.45
June 1	22.16	44.32	359.0	93.16	45.5	2.05
" 8	21.00	42.00	315.0	85.87	40.5	2.12
" 15	28.00	56.00	495.0	121.69	48.5	2.51
" 22	30.66	61.33	405.0	120.11	67.5	1.77
" 29	35.00	70.00	495.0	140.24	42.5	3.30
July 6	32.33	64.66	393.0	123.38	49.0	2.52
" 13	34.33	68.66	320.0	121.66	31.0	3.92
" 20	42.00	84.00	350.0	144.86	64.5	2.24
" 27	53.33	106.66	300.0	170.07	52.0	3.27
August 3	56.33	112.66	350.0	182.82	53.5	3.41
" 10	63.33	126.66	255.0	192.24	61.5	3.12

Table II shows that taking the entire time from the thirteenth of April to weaning as a whole, neither sow gained or lost a material amount. In the above tables, therefore, the weights of the sows have been disregarded and the gains of the pigs alone considered, hence the variation between the amounts of dry matter recorded per pound of

gain for the first weeks of these tables and the amount given in Table III where the net gain of the sow and pigs taken together are given.

The fact that young animals of all kinds make gains more economically than older and heavier ones has already been shown by a host of experiments. It is confirmed by the tables last given. Comparing the amount of dry matter eaten per pound of gain before the pigs weighed 50 pounds each with the corresponding amounts when the pigs were gaining from 50 pounds in weight to 100 pounds, and again when they weighed over 100 pounds, we find that the Duroc Jerseys required but 2.44 pounds of dry matter to make a pound of gain before they averaged 50 pounds; 3.06 pounds of dry matter per pound of gain between 50 and 100 pounds and 4.23 pounds of dry matter per pound of gain after the pigs averaged 100 pounds in weight.

Owing to the shrinkage in the weight of the sow before the pigs were weaned, the Poland China pigs do not show the point so clearly, but even with them it required but 2.93 pounds of dry matter on the average to make a pound of gain before they weighed 50 pounds apiece as against 3.11 pounds thereafter.

Compiling the results of 21 trials at this station and elsewhere involving the feeding of 87 animals for periods varying from 30 to 135 days in which the feed was composed of skim milk and corn meal, and 10 trials, using 60 animals with pigs under 50 pounds in which the feed consisted of skim milk, corn meal and middlings, it is shown that for the weights given the pounds of dry matter required to produce a pound of gain was as follows:

For pigs weighing less than 50 pounds		2.57	pounds.
" " " " " 100 "	and over 50	2.39	"
" " " " " 150 "	" " 100	3.16	"
" " " " " 200 "	" " 150	3.27	"
" " " over 200 "		3.90	"

These figures indicate that the older and heavier pigs grow, the greater the amount of feed it takes to maintain them and the less profit in keeping them. The period before the pigs weigh 50 pounds is an exception, but it must be remembered that during this period the pig is weaned and is subjected to other adverse conditions against which he is less able to battle, facts which account for the slightly larger food requirements at that time.

II. Gains of Pigs and Calves Compared.

To compare the food cost of a hundred pounds of gain of pigs with that of calves the gains and feed consumed by two calves were weighed and recorded. One of the calves was a thoroughbred Holstein bull and the other a Brown Swiss heifer, both 11 days old when the experiment began.

The record of their feed and gains are given in the following table. The grain ration consisted of a mixture of one part oil meal, two parts oats and two parts bran, fed dry. They were also given what clover hay they would eat.

The test began on the fourteenth of April. Up to the middle of May the calves had nothing but separator skim milk, as they refused to eat either hay or grain. The amounts of the latter eaten thereafter are given in the tables. After June 24, the Holstein calf had whole milk instead of skim milk.

TABLE VIII.—*Showing by weeks the weights of calves, gains, grain, hay and milk consumed, total dry matter therein and pounds of dry matter per pound of gain.*

HOLSTEIN.

Week ending.	Weight. Lbs.	Gain. Lbs.	Grain. Lbs.	Hay. Lbs.	Milk. Lbs.	Dry matter. Total. Lbs.	Pounds dry matter to 1 pound of gain.
April 14	119.	....	....	....	....	....	....
" 21	130.	11.	....	....	139.5	13.39	1.22
" 28	141.	11.	....	....	146.5	14.06	1.28
May 5	150.5	9.5	....	....	141.5	13.58	1.43
" 12	161.	10.5	2.5	1.6	139 5	16.98	1.61
" 19	170.	9.	2.5	1.6	143.0	17.32	1.92
" 26	184.5	14.5	2.5	1.6	164.0	19.33	1.35
June 2	200.	15 5	3.5	2 25	178.0	22.09	1.42
" 9	214.	14.	.68	4.	204.5	23 62	1.68
" 16	222.	8.	5 27	3.5	294.0	27.62	3.45
" 23	242.	20.	2.57	3.0	214.0	26.17	1.30
" 30	256.	14.	2.50	1.5	221.5	25.63	1.83
July 7	263.	7.	1.50	1.	224.0	24.57	3.51
" 14	280.	17.	4.00	3.	224.0	28.47	1.67
" 21	302.	22.	7.00	5.	224.0	32.81	1.49
" 28	323.	21.	19.00	9.	226.0	47.03	2.24
Aug. 4	347.	24.	12.00	9.	224.0	40.61	1.69
" 10 (six days)	364.	17.	11.00	11.	192.0	38.21	2.24

BROWN SWISS.

Week ending.	Weight. Lbs.	Gain. Lbs.	Grain. Lbs.	Hay. Lbs.	Milk. Lbs.	Dry matter. Total. Lbs.	Pounds dry matter to 1 lb. gain.
April 14	105.5	....	....	....	....	....	....
" 21	115.75	10.25	....	....	130.75	12.75	1.24
" 28	123.75	8.00	....	....	143.50	13.78	1.72
May 5	132.0	8.25	....	....	138.00	13.25	1.66
" 12	135.0	3.00	2.5	1.6	138.00	16.84	5.61
" 19	148.0	13.00	2.5	1.6	140.00	17.03	1.31
" 26	158.0	10.00	2.5	1.6	161.00	19.05	1.90
June 2	168.0	10.00	2.0	2.25	172 00	20.21	2.02
" 9	176.0	8.00	5.25	2.75	188.00	25.02	3.13
" 16	193.0	17.00	5.25	1.75	200.00	25.33	1.49
" 23	210.0	17.00	5.50	2.00	211.00	26 83	1.58
" 30	223.0	13.00	6.50	3.25	192.50	26 98	2.07
July 7	220.0	-3.00	5.50	2.50	206.00	26.77	....
" 14	239.0	19.00	10.50	4.00	206.50	32.51	*3.70
" 21	252.0	13 00	11.00	6.50	211.00	35.05	2 69
" 28	263.0	11.00	14.00	7.50	209 00	38.79	3.52
Aug. 4	281.0	18.00	16.50	10.50	209.50	43.58	2.42
" 10 (six days)	292.0	11.00	15 50	9.00	180.00	38.61	3 51

*Average for two weeks.

The gains of both calves were irregular from week to week, due perhaps more to variation in the contents of the bowels than to differences in the weight of carcass itself. In the following table the gains, average dry matter per pound of gain, and the average amounts of feed required to produce 100 pounds of gain are given for the two calves for periods of five weeks.

TABLE IX.—*Showing food required for 100 pounds of gain.*

Five weeks ending	BROWN SWISS. Total gain. Lbs.	Dry matter per 1 lb. gain.	Required per 100 pounds gain. Milk. Lbs.	Grain. Lbs.	Hay. Lbs.	HOLSTEIN. Total gain. Lbs.	Dry matter per 1 lb. gain.	Required per 100 pounds gain. Milk. Lbs.	Grain. Lbs.	Hay. Lbs.
May 19	42.5	1.73	1,388	12	7	51	1.49	1,392	10	6
June 23	62.0	1.89	1,503	33	17	72	1.65	1,464	20	20
July 28	53 0	3.02	1,934	90	45	81	1.95	1,630	42	24
Aug. 10	29.0	2.83	1,343	110	67	41	1.92	1,015	56	50

These calves were able to make gains on a very low consumption of dry matter. The Holstein, having fresh milk unskimmed after the 23d of June, continued to put on flesh at a food expenditure of not quite two pounds of dry matter per pound of gain, certainly a very creditable performance.

In the following table a comparison is made between the average amount of grain and milk required by the Duroc Jersey and Poland China pigs in the three periods reported in Table III for 100 pounds of gain and the average amount of milk, hay and grain required for 100 pounds of gain by the Brown Swiss and Holstein calves.

TABLE X.—*Pigs and calves compared.*

	Required for 100 pounds of gain. Milk. Lbs.	Grain. Lbs.	Hay. Lbs.	Dry matter. Lbs.
Duroc Jersey pigs	867.9	226.4	....	283.23
Poland China pigs	846.2	225.1	....	280.00
Holstein, skim milk	1,423.0	15.0	13	161.34
Holstein, whole milk	1,323.0	49.0	37	206.94
Brown Swiss	1,542.0	61.0	34	230.82

The pigs and calves in these experiments were subjected to the same conditions of weather and treatment. Their grain ration was different. The pigs demanded a very much larger proportion of grain to milk than the calves.

Keeping these facts in mind the conclusion that the calves put on their gains at an appreciably less expenditure of dry matter will not be misinterpreted. The Holstein required more dry matter when consuming whole milk than skim milk, simply because he was older at the time he received it. While both calves were healthy and thrifty the fact that the Holstein made more economical gains than the Brown Swiss is worthy of note.

BACTERIA—WHAT THEY ARE, WHAT THEY DO, AND HOW THEY ARE CULTIVATED.

BY C. E. MARSHALL.

Bulletin No. 139.—Veterinary Department.

GLOSSARY.

Aërobes.—Bacteria which require free oxygen.

Agar-Agar.—A preparation of dried sea weed found on the eastern coast of Asia.

Anaërobes.—Bacteria which will not live where there are traces of free oxygen.

Arthrospores.—Bacterial cells which assume the characteristics of spores.

Asporogenic.—Applied to bacteria incapable of producing spores.

Bacillus (plural, bacilli).—A rod-shaped micro-organism.

Bacteria (singular, bacterium).—A generic name representing the entire class of micro-organisms.

Bacterium.—In the generic sense the singular of bacteria; in specific sense, a very short rod or bacillus.

Biological.—Pertaining to the study of life.

Blood-corpuscles.—Circular cells existing in blood.

Blood serum.—The straw colored liquid expressed from blood clot.

Bouillon.—A beef tea containing dry peptones.

Brownian motion.—A vibratory motion.

Capsules.—A gelatinous substance enveloping bacteria.

Carbon.—A chemical element entering into the composition of all organic compounds.

Cell.—The ultimate division of organized living matter.

Cellulose.—A woody fiber-like substance.

Cell-wall.—A sheath enveloping a cell.

Chain.—Several micrococci joined together as a string of beads.

Chromogenic.—Applied to bacteria producing pigment.

Cilia (singular, cilium).—Lash-like appendages.

Clostridium.—Designates an enlargement at the middle of a bacillus, produced by the formation of a spore.

Colony.—An aggregation of bacteria springing from a single micro-organism.

Culture.—Bacteria under cultivation in a suitable soil.

Diplococcus (plural, diplococci).—A kind of micrococci arranged in pairs.

Disinfection.—A process by which pathogenic bacteria are rendered inactive, or killed.

Endospores.—Spores formed within a cell.

Fermentation.—A process of chemical change instituted by a ferment as produced by yeasts or bacteria.

Fission.—The constriction of the cell-wall in the process of multiplication.

Flagella (singular flagellum).—Same as cilia.

Fungus (plural fungi).—A low form of plant life free from green pigment (chlorophyll); it obtains its substance from organic matter.

Gelatin.—A jelly like substance obtained from animal tissues.

Germ.—That from which vegetable or animal life develops. Is frequently used as a synonym of microbe.

Germination.—The process of development which the germ undergoes.

Hanging-drop.—A small drop of fluid in which bacteria are suspended for the study of their natural condition.

Homogeneous.—Uniform consistency throughout.

Hydrogen.—A chemical element occupying an important place in organic chemistry.

Incubator.—An apparatus for holding an even temperature during an indefinite period.

Maximum.—The highest.

Medium.—A material for the cultivation of bacteria.

Microbes (singular, microbe).—Same as bacteria.

Micrococcus (plural, micrococci).—Spherical bacteria.

Micro-organisms.—Same as bacteria.

Micro-millemeter.—One twenty-five thousandth of an inch.

Minimum.—The lowest.

Morphology.—The study of form.

Moulds.—A class of fungi.

Nidus.—A nest or home.

Nucleus.—A very dense and essential portion of a cell.

Optimum.—Best.

Oxygen.—A chemical element widely distributed through nature.

Pasteurization.—The process of eliminating most bacteria.

Parasitic.—Applied to those bacteria existing on living matter.

Pathogenic.—Applied to those bacteria producing disease.

Peptones.—Digested muscle fiber.

Petri-dish.—A dish used for plating.

Photogenic.—Applied to bacteria emitting light.

Plate.—A piece of glass upon which solid media are spread for the isolation of different species of bacteria.

Platinum.—A white metal withstanding a high degree of heat.

Proteid.—An albuminous substance.

Protoplasm.—A semi-fluid, translucent material found in the body of all living cells.

Real Motion.—Motion from place to place.

Refringent.—Refractive, glistening.

Saprogenic.—Applied to bacteria producing putrefaction.

Saprophytic.—Applied to bacteria living on dead matter.

Sarcine.—Micrococci grouped in cube-shaped masses.

Spirillum (plural, spirilla).—Screw shaped micro-organisms.

Sporadic.—Isolated.

Spore.—Oval glistening body inside of the bacterial cell.

Spore-wall.—The dense sheath covering the spore.

Staphylococcus.—A species of micrococci arranged in grape-like clusters.

Sterilization.—The process of killing or removing all bacteria.

Streptococcus.—A species of micrococci arranged in chains.

Tetrad.—A grouping of four micrococci.

Threads.—The joining of bacilli end to end in rows.

Toxicogenic.—Applied to bacteria producing poisons.

Translucent.—Semi-transparent.

Vegetative cell.—Cell capable of multiplying.

Vibrio.—A comma shaped micro-organism.

Yeasts.—Unicellular plants which multiply by budding.

Zoöglea.—A massing of bacteria by means of an adhesive cell wall.

Zymogenic.—Applied to bacteria producing fermentation.

INTRODUCTION.

The science of bacteriology has entered into such an intimate relation with the farmer, because of its connection with the dairy, the soil, the silo, the diseases of animals and plants, and his surroundings, that some knowledge of it becomes indispensable to him. Thus far he has been met with reports and treatises of a technical or semi-technical character, simply because reports and treatises assume that an elementary knowledge of this subject exists, and because a report or treatise cannot be written absolutely free from terms of a technical nature. Explanations are not satisfactory where they are short and unsystematic.

The Michigan experiment station shall strive to make the work in bacteriology useful to every man who can read the English language and is interested in the matters of which this science treats. To accomplish this object, short and simply written bulletins will be issued from time to time, paving the way for the reports of experiments which must be of a semi-scientific character from their very nature. It is desired that these bulletins be near at hand for immediate reference and that they be wide enough in scope to answer and explain the various questions which naturally arise from a perusal of bulletins and in practical life.

In a few words, a general survey of bacteriology, covering those phases of the science especially applicable to agricultural interests, will be undertaken.

TERMS.

Some confusion prevails in regard to the terms applied to the organisms constituting the class of life included in bacteriology. Perhaps the most specific general term in use and most representative is bacteria, that which enters into the formation of the term bacteriology; yet a term so significant as micro-organisms—small organisms—must not be disregarded. Again we find in the word, microbes, about the same fullness of meaning as in micro-organisms. Sometimes the most non-specific term, germs, is employed, evidently because it is short and euphonious, rather than from any value it possesses in this connection.

Bacteria.
Micro-organisms.
Microbes.
Germs.

THE SCIENCE OF BACTERIOLOGY.

Bacteriology has for its aim the study of bacteria, in their morphological and chemical aspects. Often the yeasts occupy a share of the science along with certain moulds, probably for no other reasons than their close relations to bacteria and the similarity of the methods used for the study of each. Yeast fermentations have always been associated with the study of bacteria. Pasteur united them under one common and natural department of experimentation by his early labors upon fermentation.

WHAT ARE BACTERIA?

It is not safe to attempt a definition inasmuch as many modifications would be necessary. A few of their characteristics may be mentioned, and these will convey to the reader sufficent data to formulate in his own mind a satisfactory notion of these minute forms of life. They are

Definition. Bacteria. unicellular plants; that is, instead of possessing a complex structure of many cells, as the plants visible to the naked eye, they are but single cells, translucent, and have a definite form. In their multiplication, one cell divides and produces two, each of these two divides and both together produce four.

Yeast. A yeast cell, instead of multiplying by division or fission, increases by

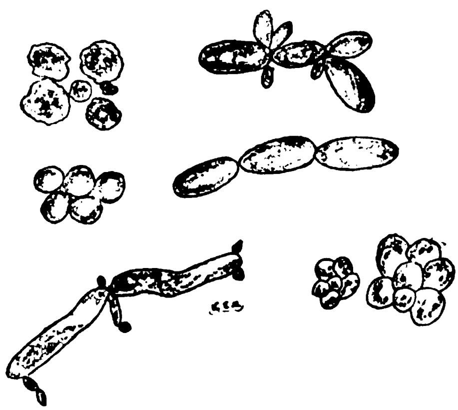


Fig. 1. Yeast cells.

budding. From the parent cell buds off a daughter cell, smaller than the parent cell.

Moulds. In moulds the growth is much like twigs, with the formation of long thread-like shoots.

CLASSIFICATION OF BACTERIA.

In the animal and plant kingdoms classifications are based largely upon anatomical structures and physiological functions. Form does not take a part to any great extent. Owing to ignorance of the structure and functions of the bacterial cell, a classification based upon them is infeasible; consequently the classification rests entirely upon the form which is easily studied. Three distinct forms exist.

Bacillus Shape. The first is a rod shaped cell, called a bacillus—plural, bacilli. Conceive little translucent rods, with rounded, tapering or square ends,

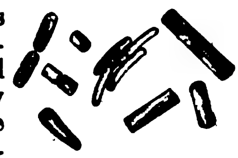


Fig. 2. Bacilli.

the length of which is two to ten times the thickness of the rod. The length of any species varies considerably, yet it has its limitations. The diameter of the rod is more likely to remain constant, still this will vary slightly. The figures just pointed out indicating the ratio of thickness to length, bearing in mind the constancy of the diameter, will illustrate the possibility of variation.

Size. The size of these cells is measured by a unit called a micro millimeter or micron, which is equal to $\frac{1}{1000}$th millimeter, or about $\frac{1}{25000}$th inch. This unit is indicated by the Greek letter mu. m. The length of a bacillus will vary from one to ten microns. The bacillus which causes tuberculosis measures about 2 m. or $\frac{2}{25000}$th inch in length; that is, considering the human red blood corpuscles equal to $\frac{1}{3200}$th inch in diameter, it would require nearly four bacilli arranged in a row end to end to reach across the cell. It is possible to distinguish markings of $\frac{1}{200}$th inch with the naked eye. In order to make a thread of bacilli as above, that would correspond to the $\frac{1}{200}$th inch, sixty-two and one half bacilli would be needed. There may be several hundred thousand of these bacilli confined within a drop of water. Some bacilli are much longer and larger than the tubercle bacillus, and there are others much smaller. A rod, straight, whose length is greater than its diameter, is usually called a bacillus.

Bacterium. To a short, thick rod whose length is about equal to its diameter, the term *bacterium* has been applied. In this sense it is used specifically, but is also employed generically as the singular of bacteria.

Micrococcus. Coördinate with bacillus in the classification based upon form is the micrococcus, a small sphere.

Shape. Instead of being a rod shaped organism, as the bacillus, the micrococcus is round and ball shaped.

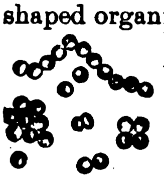


Fig. 3. Micrococci.

Size. The size of a micrococcus does not vary so much as a bacillus, yet it is not constant. Some micrococci are much larger than others, still the average micrococci have a diameter which is about equal to the diameter of a bacillus. One micron indicates about the average diameter of each. To illustrate, it would take 25,000 micrococci arranged as a string of beads to equal in length the diameter of a medium sized plum. These cells are not always perfectly spherical, but may be almost cube shaped, compressed on several sides, or they may be biscuit shaped or may be pointed on opposite sides.

Spirillum. Along with bacilli and micrococci is another form which completes this classification.

Shape. This form is screw shaped or spiral; the screw of a corkscrew fairly represents this form. Such micro-organisms are known as spirilla, the singular of which is spirillum.


Fig. 4. Spirilla.

Size. The lengths of these bacteria vary more than any of the other forms. They may be much longer than any of the bacilli and again may not exceed some of the shorter in length.

Vibrio. There are many of the spirilla made up of segments, one segment consisting of only one curve of the spiral. When a segment of this kind exists by itself,

forming a complete organism, it is usually called a *vibrio*. Thus we speak of the micro-organisms of Asiatic cholera—the vibrio of Asiatic cholera. Classification:

1. Bacillus—bacilli—rod shaped micro-organisms.
   a. Bacterium—short, thick micro-organism.
2. Micrococcus—micrococci—spherical micro-organism.
3. Spirillum—spirilla—spiral micro-organisms.
   a. Vibrios—single curved micro-organisms.

PROTOPLASM.

The contents of a bacterial cell are normally homogeneous, translucent, and refringent, corresponding closely to the protoplasm, a semi-fluid and almost transparent mass, found in other living cells. So far as known the cell possesses no nucleus; still evidences of its existence are present. While the protoplasm is usually homogeneous, there are conditions when the opposite will prevail. Laboratory workers are acquainted with certain changes in the protoplasm induced by unfavorable media upon which they grow, by the direct rays of the sun, by a high degree of heat, and by certain chemicals. These agents are artificial. A natural change in the protoplasm occurs when the cell enters the stage of spore production. The protoplasm will then break up into different sized granules which move towards the center and coalesce.

Appearance.

Nucleus.

CELL WALL.

The sheath which encloses the protoplasm is of great interest as well as importance. Its composition seems to be that of woody fiber, cellulose, as has been established by micro chemists. The demonstration of it is dependent largely upon inference and analogy. Owing to certain peculiar arrangements of bacteria and the linking of cells, it does not seem possible that such could occur unless the cell be sheathed. Again, by the action of iodine, the protoplasm can be made to retract from the cell wall, leaving it behind, unassociated with anything, as a well defined line. With certain species the cell wall becomes enlarged resembling a gelatinous mass. When this is characteristic of a species, it is spoken of as a capsulated micro-organism. The great importance belonging to the cell walls of bacteria is their power to resist external agents of destruction. While the cell wall of one species will resist a comparatively high degree of heat or low degree of cold, that of another seems to have no resisting power at all. Someone may ask whether this power of resistance does not lie in some other portion of the cell structure; perhaps it does, but the indications lead us to believe that the cell wall is the greatest factor. More light will be shed upon this matter as we proceed. At this point a consideration of motion and flagella will be fitting.

Composition.

Demonstration.

Capsules.

Resistance.

MOTION

Many bacteria move and their motions differ. One species has a tumbling motion through the liquid in which it is suspended, another a darting motion, and still another a snake-

Kinds.

like motion, all of which are progressive, moving from one **Actual.** place to another. These bacteria possess actual motion. There are other bacteria which have only a vibratory motion, or an up and down motion, but do not move from one place to another. **Brownian.** This kind of motion is known as Brownian motion. Again, there are other bacteria which remain absolutely still.

FLAGELLA.

Associated with actual motion in bacteria are organs of propulsion, called flagella, cilia, and even whips, because they are whip-like **Composition.** appendages. From some of their reactions to stains; they resemble the structure of the cell wall, and may be merely a continuation; yet if they really are concerned in the movements, it would seem more plausible to consider protoplasm **Arrangement.** as part of their structure. Bacteria differ widely in the arrangement of their flagella. The bacillus may have but one flagellum or it may have numerous flagella. When possessing only one, it is placed at the end, but if many, they radiate from all sides. In the micrococcus the whip proceeds from the side. Very few micrococci are known to have whips. The true spirilla possess a bunch of flagella at each end, and the vibrio a single whip at the **Size.** end. The ordinary flagella are three to ten or twelve times the length of the micro- **Giant.** organism. In a few species, what are known as giant whips have been found which are forty to sixty times the length of the micro-organism.

Fig. 5. Flagella.

SPORES.

In the discussion of protoplasm, reference was made to its condition just before the formation of the spore. It becomes granular **Formation.** and more refringent. The granules gradually proceed towards that portion of the cell, where the spore is in process of formation; there they coalesce, take on a membrane or sheath and assume the form of a spore. This spore may be located **Location.** at the end of the cell, at the middle, or any place between the middle and the end. It may be wider than the cell, thus causing a bulging. In such a case, when the spore is located at the end, it will produce a club shaped or a drum stick shaped micro-organism. When the spore is in the middle and produces a bulging, it gives rise to the clostridium form. Wherever the spore is in the cell, it undergoes about the same life history.

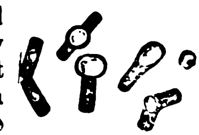


Fig. 6. Spores.

As soon as the cell has produced its spore, it will begin to dis- **Germination.** integrate and eventually leave the spore free. This spore will not generally germinate when left in the same medium in which it was produced, but if transferred to a suitable medium will

develop into another cell; that is, a cell may produce a spore, but it dies in the act; yet it has its life continued through the spore which will in turn give rise to a cell. Sporulation does not mean multiplication but simply a transmission of life. When the spore germinates, it throws

Endospores. off the sheath enshrouding it and the young cell comes forth. This mode of formation, when the spore is within the cell, is called endospore formation. In this class the spores appear as bright oval bodies, highly refractive, much more so than the protoplasm of the cell, and markedly uniform. On the other hand, there are

Arthrospores. those cells which become more refringent as a whole, seem to resist staining reagents more than their associate bacteria, and in short to assume the qualities of a spore. Such spores if they do actually exist are called arthrospores. There are many bacteria in which no spore formation has been observed; for this reason this indefinite class of arthrospores has crept in; still it bears with it considerable valuable evidence. Certain spore bearing bacteria when grown

Asporogenic. under unfavorable conditions will cease to produce spores.

Spore wall. Such bacteria are called asporogenic bacteria. The spore wall which breaks away when the young microbe starts on its career, is of the greatest importance in the bacteriological economy.

Resistance. It is perhaps one of the most resistant and impenetrable of substances making up plant life. Were it not for the spores, bacteria would be easily eradicated. They are exceedingly resistant to heat, sunlight, dessication, stains and chemicals. Spores are known which will resist twelve hours of steaming, will live for months in the direct rays of the sun, will endure for years in dust, will not react to ordinary staining methods, and will be unharmed after hours in a strong germicidal solution. This feature of the morphology of bacteria plays a decided practical rôle in bacteriology. The inability to sterilize milk is largely due to this characteristic of some bacteria; the continuous existence of anthrax in some localities is also based upon this fact. Spores are the most formidable obstacles a bacteriologist has to contend with.

GROUPING OF BACTERIA.

Besides the classification of bacteria founded upon forms and spores, there is another not used so much to systematize bacteria, but to a considerable extent as a characteristic in the identification of species. Some bacilli always remain ununited with others of their kind; there are those which unite in pairs,

Threads. the ends are contiguous to each other, and still those which form long threads or rows, united end to end. Again bacilli may have characteristic groupings; the bacillus of tuberculosis is generally arranged in clusters of three, four, or more bacilli, and the grouping of these bacilli is not peculiar to any other variety. With the micrococci, the groupings are more noticeable and pronounced. As with bacilli, micrococci may be arranged alone or in pairs and other groups. They are not especially designated when existing

Fig. 7. Threads of bacilli.

Fig. 8. Diplococci.

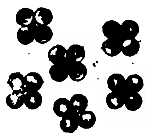


Fig. 9. Tetrads.

Diplococcus. alone, separated from others, but when united in pairs, they are called diplococci. Groups of fours are also quite common and to these groups the name, Tetrad. tetrads, is given. Another arrangement is where several of these tetrads are arranged and brought together so as to form a cube. These cube-like masses are Sarcine. sarcines. If micrococci are arranged together so that one follows the other in a line, they will have the appearance of a chain or a string of beads. Cocci so joined Streptococcus. are known as streptococci. They may be arranged in bunches looking much Staphylococcus. like a cluster of grapes; when so grouped they are called staphylococci. Bacteria in general are many times found in large masses visible to the naked eye, and are closely adherent to each other. Such masses are Zoöglea. zoöglea. This condition is usually produced by the structure of the cell wall in such cases. There seems to be a gelatinous substance surrounding the cell due to a hydrated condition of the cell wall.

Fig. 10 Streptococci.

Fig. 11. Staphylococci.

FISSION.

The matter of fission or division in bacteria influences largely their arrangement or grouping. It is easy to conceive a bacillus dividing in two and these two in four and so on by constrictions which Single Fission. gradually separate the bacilli. If these constrictions are complete, the bacilli will appear single, if not they will form in threads. The same thing takes place with micrococci; if the constrictions are complete, they are single; if not complete, they form chains which correspond to threads of bacilli. By some authors these words thread and chain are used synonymously. Should a micrococcus divide and form two, a diplococcus would exist, but if these Double Fission. two should divide in a direction opposite to the first, a group of four or a tetrad would be formed. In this case there are divisions in two directions. Now consider a division of the Tripple Fission. cocci constituting the tetrad in a third direction, producing a cube shaped mass, the resulting group would be a sarcine. Multiplication. Through fission, multiplication of bacteria occurs. When placed under proper conditions it is very rapid, in some species every half hour. This increase in a geometrical ratio conveys some notion of the number of bacteria one micro-organism will give rise to in the course of twenty-four hours. The multiplication would be like this:

At the beginning there is one bacillus.
" " end of the first half hour there will be two bacilli.
" " " " " second " " " " " four "
" " " " " third " " " " " eight "
" " " " " fourth " " " " " sixteen bacilli.
" " " " " fifth " " " " " thirty-two bacilli.
" " " " " sixth " " " " " sixty-four "
" " " " " seventh half hour there will be one hundred twenty-

eight bacilli. This is three hours and one-half from the beginning of the multiplication. At the end of the tenth hour, following out the same ratio of increase, there will be one million one hundred seventy-six thousand five hundred and seventy-six. Computations made concerning the multiplication of one micro-organism for a week's time, provided everything were favorable, give startling results.

Classification according to fission:

1. Bacilli:
   a. Threads—bacilli united end to end in a row.
2. Micrococci:
   a. Diplococci—micrococci arranged in pairs.
   b. Tetrads— " " " fours.
   c. Sarcines— " " " cubes.
   d. Streptococci— " " " chains.
   e. Stapylococci— " " " clusters.

Zoöglea—the massing of bacteria.

LIFE REQUIREMENTS OF BACTERIA.

Like other plants bacteria demand proper conditions before they will develop; food suitable for their assimilation, moisture sufficient for complete solution of the food, a reaction neither strongly acid nor alkaline, and a proper temperature to favor their growth. Wheat will not grow unless these factors are observed. If the soil is void of richness, the grain of wheat sprouts and withers away; if moisture is wanting, it may not sprout at all; if the temperature is low, it scarcely grows; and if the reaction of the soil is wrong the life is stunted, as in the alkali tracts of the west. Wheat will grow in some soils while in others it is poisoned. Some fields will produce forty or fifty bushels to the acre, and other fields will merely return the seed. Again there are those plants which will grow where the wheat will not, illustrating the fact that each species of plants has its optimum soil. Just as with higher plants, so it is with bacteria. Some will grow well on a soil where others will not; on certain soils there are those which will not develop at all. Each species of bacteria has a soil which is best adapted to that species. There are however certain elements which are absolutely necessary to their growth and which must enter into their food.

Food.
Nitrogen.

Nitrogen is one of them. Remove all traces of nitrogen from their food and they will not grow. Absolutely pure fat will not undergo decomposition, neither will an absolutely pure sugar solution ferment In fat there is no nitrogen and sugar is free from it. The sources of nitrogen are however numerous. When bacteria act upon a bald rock protruding above the ground, they do not gain their nitrogen supply from the rock but from traces of ammonia in the air and from the free nitrogen of the air. These substances which they gain from the air they convert into nitric and nitrous acids and utilize what nitrogen they need for their own economy. In the soil, decomposing organic matter, such as decaying plants, is present to furnish the required nitrogen. Water has enough nitrogenous material suspended in it and in solution to provide a rich nidus for the multiplication of bacteria. Disseminated

through the air, traces of nitrogenous compounds are found. No matter in what direction the attention is turned, there is sufficient nitrogen for the needs of bacteria.

Oxygen.

Oxygen is also essential to bacteria. Many of them require the free oxygen of the air the same as man; but others are poisoned by this same free oxygen; that is, there are those bacteria which will not grow in the presence of air. Two classes of bacteria therefore spring from their reactions to oxygen of the air, the one requiring this oxygen, the aërobic bacteria; the other poisoned by this free oxygen, the anaërobic bacteria. From this the conclusion must not be drawn that the free oxygen of the air is the only source for the aërobic bacteria, and that the anaërobic bacteria do without oxygen in any form; on the contrary both classes utilize oxygen in combination with other elements as found in organic matter.

Aërobic and Anaërobic.

Carbon.

Bacteria as a rule are unable to absorb carbonic acid gas as the higher plants with their chlorophyll, yet some of them are able to employ it in their functional processes. For their own sustenance they obtain their carbon along with the other elements in organic substances. This is also true of hydrogen, phosphorus, sulphur, and inorganic salts necessary to their development.

Hydrogen, Phosphorus, Sulphur, etc.

Moisture.

No bacterial development occurs without the presence of moisture. Whenever the micro-organism finds a dry habitat it ceases to grow, although it may remain alive for days and months. Bacteria stand in need of moisture as much as the wheat plant. The spore, the most resistant form of the micro-organism, may lie dormant for years if moisture is absent. Like the grain of wheat, it will not germinate unless sufficient moisture prevails. Dust contains life, but it is not until it reaches a humid condition that it gives activity to the life within.

Temperature.

Bacteria differ widely in their relation to temperature, but every species has its minimum, optimum, and maximum; that is, there is a point so low at which a certain species will cease to grow and one so high that it will not develop, and between these extremes a point will be found at which this species will flourish best. Each species has its own minimum, optimum, and maximum temperature. Some bacteria will grow at 8° C. [46° F.] and others at 70° C. [166° F.]. As a rule, however, those found outside of the animal body will grow best at about 28° C. [82° F.] to 30° C. [86° F.], and those connected with infectious diseases require 37½° C. [98° F.] for their optimum. The tubercle bacillus develops only within a range of two degrees and others have a very narrow range of temperature, as the bacillus of glanders and the micrococcus of pneumonia; still most bacteria have a latitude of 15° or 20° in which they will grow. Meat kept below 15° C. [59° F.] will not decompose rapidly and milk will remain sweet much longer at this temperature, simply because the bacteria lie dormant and will not grow. Change in temperature is quickly noticed by bacteria.

Reaction.

Bacteria will not bear a strongly acid or alkaline solution. They may remain alive but refuse to grow. Some bacteria will grow in a slightly acid medium, but the reaction most favorable to bacteria as a class is neutral or slightly alkaline.

SAPROPHYTIC AND PARASITIC BACTERIA.

According to habitat, bacteria may be divided into two classes, saprophytic, those which live on dead matter; parasitic, those which live on living matter. Among the saprophytic are found the bacteria of the soil, air, and water, and any which do not find their natural conditions when living matter is present. On the other hand, a truly parasitic micro-organism will not live unless associated with life. Nearly all the bacteria producing infectious diseases are able to live on both living and dead material. There are no fast lines to be drawn in this matter of classification.

PATHOGENIC AND NON-PATHOGENIC BACTERIA.

The first of these produce disease by arresting certain functions of the organism or by a change in their tissues. Poisons emanating from this class of micro-organisms enter the circulation and give rise to the symtoms manifested in the disease. The non-pathogenic bacteria are unable to develop poisons or institute changes within the animal or plant economy.

DISTRIBUTION OF BACTERIA.

The requirements of bacteria indicate their distribution, for each factor entering into these requirements must determine the existence of bacteria in any geographical location. As an illustration of this, the factor, moisture, could be well employed. It has been said that moisture is essential to bacterial growth. Other conditions being suitable, where moisture is, bacterial growth will be abundant, without it, there will be no development whatever. Put away a piece of leather in a moist cellar, it will contract moisture and upon its surface will be noticed certain fungus growths; place it then in a dry atmosphere, the fungus growths will disappear. What explanation can be offered! The light may have some influence, yet leather will mould in light, if moisture is present, but will not mould if there is an absence of moisture. Bacteria act as the moulds. Remove the moisture from a piece of meat and it will keep indefinitely. Fruit is dried that it may keep any length of time; if moisture were to be supplied to that dried fruit, it would decompose within a few hours. Oats in a shock are safe against mould and decay till the rain provides moisture for the latent life that is ready to germinate. Consider for a moment the decomposition that is constantly in process. Organic matter everywhere will decay if moisture is present, take away the moisture and the decomposition will stop. There are certain localities where an animal will dry up, when falling dead, because the moisture is so rapidly evaporated that the bacteria will not have an opportunity to begin their operations of disintegration. Not far from this locality the opposite may exist. The animal will fall dead, and the bacteria will soon commence their work of disassociation; not long after the animal will be reduced to the ashes from which it sprang. Moisture, however, is only a factor in the distribution of bacteria and has been used merely to illustrate the importance of single factors in the determination of bacteria any where in nature. The other factors, food, temperature, reaction of media, each in turn could be shown to render a part in the distribution of bacteria, as important as moisture, but their importance will appear without especial illustration in the body of the discussion.

This subject presents treatment under three distinct heads, although a few media of distribution may scarcely be classified, and will accordingly be considered separately. These three heads are:

1. Air.
2. Water.
3. Soil.

Air. The air can hardly be regarded as a natural home for bacteria, notwithstanding the fact that many are found there. Most of the species found in the atmosphere are non-infectious; very few pathogenic bacteria have had their presence demonstrated by direct examination. Organic matter and moisture are the measure of bacterial life in the air about us. The dust which rises from the streets, laden with pulverized sputa of people with infectious diseases, and filled with the offal of horses, disseminates through the air a multitude of bacteria. The material conveyed directly to the air from the lungs of the inhabitants and the sweepings from houses and shops provide a fertile soil for bacteria. The ware-room where rags are handled and skins are carted about, numbers its victims every year, the one dying of cholera, the other of anthrax. The city has the largest number of bacteria, mid-ocean the smallest. Where life is so active and every foot covered by habitation, it is a natural result that the air of the city should furnish its equally dense proportion of life. Mid-ocean on the contrary has little opportunity of feeding micro-organisms although moisture may be in abundance. The air is consequently practically free from bacteria. The extremes have been drawn. The country with its scattered dwellings, the plain with its single house, the mountain with its bare rock,—all of which appear mid-way between the city and mid-ocean,—are not able to muster a regiment of bacteria to antagonize man. There are the winds and currents of the air to carry these fine particles of life over miles of country. Cinders from a volcano have been estimated to pass through hundreds of miles of air before they fell, and cinders are hardly comparable with bacteria. It is impossible to state the influence of currents of air upon bacteria, yet it must be great. Influenced greatly as they may be by currents of air and wind, bacteria always gravitate towards the ground and will eventually reach the soil.

Water. Water may contain very many or very few bacteria; it rests wholly upon the kind and supply of food. Rivers flowing down the sides of mountains covered with dense wildernesses, lakes whose banks are free from inhabitants, and seas which measure thousands of miles in extent can boast of a scarcity of bacteria. There is but little decaying matter to be transported by these waters, and little opportunity for gathering sewage of habitable districts to supply the little nourishment required for the growth of bacteria. From the other side, view the conditions existing along streams in our thickly settled states where town after town pours its sewage into them and where there are only two or three miles intervening between the towns for purification; also regard the borders of our lakes, where large cities have their intake pipe for their water supply only a few yards away from the outlet of the sewerage system. The water about the shores of lakes is usually very quiet and there is little chance for bacterial life to vanish. Here is the best food imaginable for growing bacteria. The waters of such places are pregnant with these forms, some of which are detrimental and some harmless. Bacteria are associated with habitation; they are essential for the reduction of the organic wastes given

off by man, and nature has her way of disposing of them over which man has little control. It may be asked what condition is found in underground streams and wells. There are many springs which have their source deep in the earth, the fountain of whose water may or may not be free from contamination. Imagine two strata of rocks which emerge from the earth at a thickly inhabited district and rich in filth. From this spot the water may percolate through the soil between the strata of rocks and in time find its exit in a sparkling spring of water. It is a matter of quite common occurrence to find living infusoria in such water which are generally traceable to a source of surface water. How much easier it would be for bacteria to find their way! What applies to a spring, applies equally to a well; and many times wells are discovered to be the receptacle of a back-yard cesspool. Rain water is usually comparatively free from injurious bacteria, provided the cistern is clean and the first dash from the roof during a rain storm be turned into the waste pipes.

Soil. While in some respects soil does not bear so much interest as water, in others it conveys a richness of interest to our minds which neither air nor water has presented. In the early days of bacteriology little was thought of bacteria in connection with growing crops; now it promises to be one of the richest as well as most formidable branches of bacteriology. Every new fact that comes to light in connection with nitrifying bacteria signifies the possibilities of this line of work. When the farmer spreads broadcast his barnyard manure or his blacking upon his fields, he does not add so many chemical constituents as he does bacteria which will change his soil to profitable and utilizable fields. The nitrogen of nature which was growing so scarce before the eccentricities of the nitrifying bacteria were known, will doubtless cease to be a speculative element in the presence of this class of bacteria. Not only does the soil furnish nitrifying bacteria but also putrifying and other fermenting bacteria. In a heap of compost there will be found millions of bacteria at work upon the material forming it. Each species represents a specific function to a certain degree. The slops in the back-yard, the decaying matter stored in the cellar, the putrifying material scattered about the lot,—all are the homes of bacteria. The city soil, where there is so much filth, incubates bacteria day and night, and the ground is burdened with them. Here is the home of the tetanus bacillus which gives rise to lockjaw, here the typhoid bacillus sojourns, and here the source of many other infectious bacteria. A pasture upon which cattle diseased with anthrax have died may harbor the bacillus for years. The bacillus of blackleg also lives in the soil and finds its way into the tissues with little difficulty. Disseminated through the soil are bacteria of nearly every kind, from those useful to man to those the most detrimental. In the old inhabited districts of Europe, where filth has accumulated for centuries, some of these most injurious bacteria may be found in large numbers. In such localities it is not infrequent for a lad to run a rusty nail of the soil into his foot and die in a short time of lockjaw. The anthrax districts are well defined in Europe; maps are made designating the exact positions of these places. This is also true of blackleg, but the districts are not so well defined. There are sporadic cases which can usually be accounted for in each instance by some peculiar circumstances. A field unbroken by the plow and untrampled by animals with infectious diseases contains little danger from its supply of bacteria, for they are of the variety which do no harm pathogenically. Sandy tracts of land have few bacteria owing to the

scarcity of organic matter and in many cases of moisture. Moisture and organic matter in the soil govern the activity and change connected with it, and indicate the value of the land.

Animals and Plants. To make this heading coördinate with air, water, and soil, would be an illogical division, and to make it subordinate is not reasonable. It is distinct. Animals and plants shelter bacteria and influence their distribution so greatly that it may truthfully be said that they would have no distribution were it not for these agents. Diseases of animals, tuberculosis, for instance, would not extend from pole to pole, if it were not through the instrumentality of animals. Diseases of plants do not differ much in this respect. Established facts bear out this statement and point out the relation of bacteria to animals so far as distribution is concerned. Aside from animals and plants there are doubtless other means operating about which nothing is known. With the amount of work that is now under way, it is fair to predict that the avenues of travel used by bacteria will gradually become familiar to bacteriologists in the near future. Methods will be devised to intercept them in their movements.

BACTERIAL FUNCTIONS.

Meat placed away for a short time will often reveal red and yellow spots and in fact spots of almost any color.

Many have witnessed a pool of water which would change in color as a changeable silk, when viewing it from different places.

The phosphoresence of the sea has been marveled at repeatedly. All have heard about it if not seen it.

Every housewife is conversant with the methods of using yeast to make bread, and wonders how a bit of yeast will render light a panful of bread dough.

The dairyman waits for the souring of his milk with the same degree of assurance as he awaits the arising of the sun.

The farmer makes his cider and regrets that it becomes vinegar so quickly.

There are very few who have not looked over the surface of a swamp and seen air bubbles rising to the surface of the water.

Meat will decompose before it is consumed and in this condition it has been eaten to the detriment of health.

Villages have been poisoned by attending an ice cream festival or drinking the milk procured from a single milkman.

All these phenomena have come to the attention of everybody. Have they all a meaning and are they associated with bacteria? Some of them suggest a lengthy treatment, yet at this stage satisfaction will have to be gained from very brief statements, since in some of these matters future consideration will be given. When bacteria are studied in their above relations one simply studies their offices in nature, what they do and to what products they give rise. This part of bacteriology is one of the most useful, fruitful, and practical relations of bacteria. Perhaps the investigation of bacterial products has led to more beneficial results than any other line of the science. The suggestions made at the beginning of this subject upon functions only introduce us to a wide field of research.

Chromogenic Bacteria. For many years there has always been food for superstitious people in the fact that spots of blood would appear upon their meat or bread. They considered them to be drops of blood deposited there by some supernatural power. At other times

they have noticed that their milk was colored blue, red or green. Bacteria are at work producing pigments of various colors. They evidently secrete a substance which in contact with the oxygen of the air becomes colored.

In the water are found several species of bacteria which yield a product of marked fluorescence; various shades may be noticed in the progress of their growth.

Photogenic Bacteria. There are bacteria which upon cultivation will produce sufficent light to note the time of night. There are plants which light up the sea.

In the making of bread the yeast plant is added for the purpose of fermentation. It probably gives rise to alcohol and carbonic acid gas; the alcohol evaporates when the heat is applied, and the carbonic acid gas renders the bread light by filling the dough with air spaces in its attempt to escape.

Zymogenic Bacteria. Contained within cider is a sugar upon which the bacteria feed and change it eventually into alcohol, and this alcohol into acetic acid. In the evolution of acetic acid other products are formed on the way and along with acetic acid. While in many ways it is apparently simple, it is, in reality, a very complex process.

In the souring of milk, which follows very closely the yeast action in bread and the change of cider in vinegar, the sugar of milk is converted into an acid, called lactic acid, directly or indirectly, as the case may be, and which in turn precipitates or curdles the caseine.

Aërogenic Bacteria. In swampy districts, underneath the water, there is usually more or less organic matter in process of decay instituted by bacteria. In their operations they eliminate various gases from this material. This gas rises to the surface of the water, producing the bubbles mentioned.

Saprogenic Bacteria. This decaying or putrefying process is also found in meat under another form. Meat is composed of a very complex array of elements; a greater complication would be expected in the products, which would be somewhat different. The gases formed are of a different nature and often give rise to decided odors. Such smells as that of ammonia will be noticed, and of rotten eggs, due to hydrogen sulphide.

Toxicogenic Bacteria. Intense poisons may also result from the action of these bacteria and if introduced into the system will give rise to serious trouble. The many fatal cases of poisoning from eating meat are generally traceable to decomposing bacteria.

The poisoning of milk or ice cream is much the same as meat poisoning and belongs to the same class.

LABORATORY WORK.

It may seem out of place to introduce into a simple treatise of the fundamental steps of bacteriology, a description of laboratory methods, yet an explanation will not be necessary if it is borne in mind that it is really a laboratory science; and for a successful interpretation of any article dealing with bacteria, a knowledge of the methods employed is obligatory. There is also another phase of this matter, which enhances the consideration of laboratory methods, and which, if kept in view, will lead to much practical good. This is a study of laboratory methods with the direct object of adapting them in modified forms to every-day life. If careful attention is given in the review, still another feature, accuracy in detail, will be observed in every step of an experiment. Accuracy is indeed the most essential quality to a successful worker in the laboratory.

It is a difficult task, even with the best illustrations, to describe apparatus. Without an idea of the apparatus, laboratory knowledge would be meaningless, and a comprehension of the work would be impossible. A description, therefore, of the apparatus, with a view mainly to state the principle involved, will be undertaken.

Laboratory work embraces the study of bacteria in all of their biological aspects, which signify their morphology, cultural properties, chemical products, and many other associated branches of observation. To accomplish this object it becomes necessary to enter into a consideration of means to an end. To make the subject as simple as possible, topics will be inspected in a light which will not cause much confusion. The complex apparatus will be compared with things already understood. In fact the every-day utensils about the house are embodied largely in bacteriological apparatus which are modified for convenience. These modifications are not essential for an understanding of the principle and may be entirely overlooked. Let us now attend to the laboratory work.

STERILIZATION.

From the bacteriological standpoint, sterilization is the process of rendering any substance free from bacteria; any way in which this may be done is a means of sterilization. It must not be confused, however, with such terms as Pasteurization or disinfection. Pasteurization refers to the process of reducing the number of bacteria by killing those most susceptible to a certain degree of heat; while disinfection is usually limited to pathogenic bacteria, and means either the killing or the reduction of their vitality.

Several methods are recognized in the accomplishment of sterilization. Because of the extensive application of sterilization to diverse objects and substances, it is readily seen that no method is desirable for all. They all have their particular advantages. Of the three general agents employed,

heat, chemicals and filtration, heat undoubtedly occupies the foremost place.

Heat. This agent has been used since the embryonic days of bacteriology. It was then applied continuously for various lengths of time; but as shall be seen later, the experiments were not always successful. Thanks to Tyndall for the introduction of discontinuous heating, or what is commonly called fractional sterilization. Under the consideration of spores it will be remembered that the spore wall was exceedingly resistant, much more so than the vegetative form; that some spores will withstand several hours of steam heating. Consequently it is sought to kill the vegetative form, which is done in a comparatively short time, and the spore is then allowed to develop. The process is this: When the bacteria in the vegetative form are killed the heat is discontinued and the spores are allowed to germinate. The bacteria resulting from this germination are then subjected to another heating of the same time and degree. This alternation of heating for the killing of bacteria, and cooling for the germination of spores is repeated two or three times, during which period all the spores germinate and the bacteria produced from them are exterminated. Two methods have been suggested of applying heat, continuous and discontinuous, of which the discontinuous is the most reliable. Wherever heat of a high degree is possible, continuous heating becomes feasible and even desirable in many instances.

Kinds. For sterilizing purposes, heat appears in two forms, moist and dry.

Boiling and steaming, without pressure, at 100° C. [212° F.], or with pressure at 125° C. [257 F.], illustrate the different manner of usage.

Boiling. Since boiling may be executed under most circumstances, and the apparatus for steaming is not common, the former, boiling, is the most worthy of consideration. The conditions are almost universally present to sterilize by boiling in the form of wash-boiler, kettle, pans, or almost any receptacle. If utensils can be boiled for one-half hour they are practically sterile; that is, they are about as sterile as it is possible to obtain open vessels which are to be used in the handling of exposed material. Occasionally spores are present which will resist this process, yet this is not the usual case. If bottles or pails are to be prepared for Pasteurized milk, no better means free from expense and trouble could be adopted. From the hygienic side, boiling is again exceedingly useful. Milk may be Pasteurized by boiling, and made free from infectious bacteria. To insure safety against the tubercle bacillus, diphtheria bacillus, or the typhoid bacillus, no better scheme could be devised than to bring the milk to the boiling point for a moment at least. Water, too, is often the host of the typhoid bacillus, cholera spirillum and occasionally of other infectious bacteria. To rid it of danger, boiling is all that is necessary. Contagious diseases often exist in families. The rooms where the patients live have curtains and carpets, the beds have linen and other coverings, the patients have clothing,—all of which may usually be disinfected or absolutely cleansed by boiling. The scope of boiling as a sterilizing, Pasteurizing or disinfecting agent is therefore very wide,

and it is something which is within the reach of all, while other methods may not be.

Steam. Steam heat answers much the same purpose, but is more convenient. A steaming apparatus, which will contain a hundred-fold more than any boiling apparatus, can be made and run at a very low cost. When sterilization is to be carried on day after day, it would be much cheaper in the end to have a steam sterilizer, for it would require less fuel and give much more space. It will not only answer the same purposes as boiling but will be accompanied by less risk. Milk sterilized by steam seems to be in a better condition than that subjected to boiling, for the steam heat is much more uniform and less likely to produce a change in the composition of the milk. Utensils may be handled with greater ease from a steaming vat than from boiling water, and so with other things which steam can thoroughly penetrate. In the laboratories nearly all moist sterilization is carried on by steam.

Steam Sterilizer. The apparatus used for this purpose is simple and not much different from the ordinary kitchen vegetable steamer. Conceive the kitchen vegetable steamer with its perforated bottom, its cover, and its low sides, extended till it stands from two to six feet high. Place in the center of the cover a hole for the escape of steam, because moving steam is more effectual than stagnant steam; then a steam sterilizer is complete. To make it as convenient as possible, there is a place in the cover for a thermometer and the bottom is fixed upon a suitable water vessel to which it is permanently fastened and which is usually a mere continuation of the walls, copper lined for the water and flared out to give an extensive heating surface. A glass tube connected with the water pot indicates the amount of water and a stop-cock drains off the water when desired. The upper part of this boiler-like arrangement is therefore used for a steam chamber and the lower portion, about one-sixth of the whole, is the water pot. Underneath the water pot the gas burner is placed. Wire baskets or tin receptacles are often employed for managing small articles with ease. Such a steamer or steam sterilizer is used in the laboratory; but the adjustments for con-

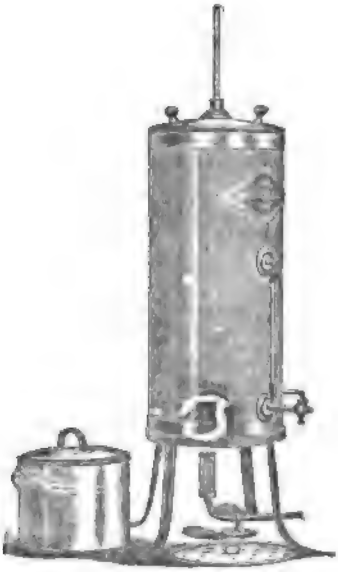


Fig. 12. Steam Sterilizer.

venience sake may be dispensed with when no degree of accuracy is demanded as in experimental work.

Autoclav. Mention has been made of the use of steam under pressure and of course at a higher degree. For this method of sterilization, a special sterilizer is necessary and is called an autoclav. This is of much the same pattern as the steam sterilizer just described, but instead of the steam escaping, the chamber is made steam tight so as to withstand several pounds pressure. At the top is a gauge to denote the pressure and a safety valve to provide against danger. The thermometer is present as in the other case. In this apparatus, the steam may be raised to 115° C. [239° F.] or 130° C. [266° F.] and one continuous heating will be equivalent to several discontinuous heatings in the ordinary steam sterilizer, thus saving much time. The activity of steam becomes far greater as the temperature passes above 100° C. [212° F.]. Owing to the saving of time from the greater activity of the steam at 130° C. [266° F.], this apparatus is much favored in some places for certain purposes.

Fig. 13. Autoclav.

Moist heat is adapted to the sterilization of media or liquids which are prone to evaporate or undergo decomposition in the process of heating. The preserving of fruits and vegetables may be accomplished by this means and in canneries this agent is utilized in some manner. Anything that will stand boiling or steaming may be subjected to this method of sterilization without detriment and may be thoroughly sterilized if the boiling water or steam will penetrate the material.

I hesitate to consider the time required because it depends upon a great variety of conditions and it is impossible to include them all. Some time is always required to raise the substance under process of sterilization to the same temperature as steam. If there is a large bulk, much time is required; if only a small bulk, a few minutes will do. With this in mind, it *may be* safe to state that two or three minutes will kill all bacteria in the vegetative form. As an illustration of this, liquid in a tube three-fourths of an inch in diameter may be sterilized at 100° C. [212° F.] for fifteen minutes each day during three successive days—the fractional or discontinuous method. Heating once at 130° C. [266° F.] in the autoclav will accomplish the same thing. If this same liquid were placed in a can holding a quart, that quart of liquid would require at least an hour's heating each day for three successive days. The situation is now stated, and the conclusion can only be an exercise of the judgment in ascertaining how long it will take to raise the substance to the degree required. In this way sterilization by moist heat is conducted.

Dry heat. As was suggested at the beginning of this discussion on sterilization, each form has its advantages over the others.

Dry heat can be made very effectual by using a high degree, which for a short time will accomplish more than could be expected of steam. Instead of using the discontinuous heating plan, one sterilization will be sufficient. Dry heat is usually applied in two ways, the direct flame and the oven.

Flame. Wherever the flame may be utilized as an agent to kill bacteria, no more positive and satisfactory means could be offered. Its uses are, however, very limited. In the laboratory, the platinum needle which is used for inoculation is brought to a red heat and is thus sterilized. Old knives and scissors employed for post-mortem work are rendered free from life. This intimates the possible uses. On the farm old knives and instruments used in the cutting of animals dead from anthrax, blackleg, tuberculosis, or any infectious diseases are safe only after they have emerged from the purifying influence of the flame. In this connection, although it does not properly belong under this head, may well be added that the disposal of carcasses in which infection was present or suspected or in fact the disposal of any material which would be likely to convey danger is by far the best accomplished through the flame.

Hot air oven. In dry heat sterilization, the hot air oven has wide application and as a practical sterilizer is of great importance. It is a simple double walled oven, having an air space between the walls which opens near and about the flame; otherwise it closely resembles the oven of a gasoline stove. In the top are holes for the thermometer and thermo-regulator which regulates the supply of gas and heat. (This instrument will be described with the incubator.)

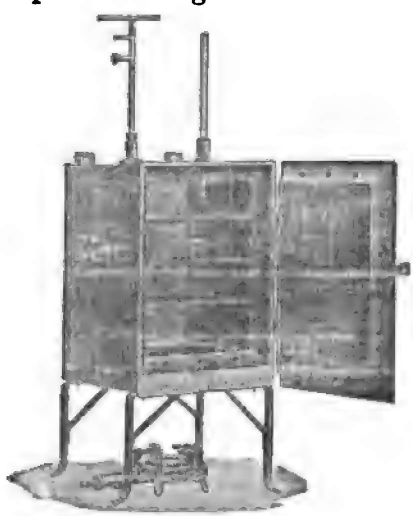


Fig. 14. Hot air oven.

The hot air oven is designed for the sterilization of glassware and other hard and dry materials not injured by an exposure to a high degree of dry heat. Clothing can be sterilized but with more difficulty than articles whose surfaces are exposed. Instruments may be made bacteriologically clean in this manner; attention must be given to the degree of heat, lest the temper which is of so much value in some instruments be destroyed.

It has been found that 128° C. [262° F.] will kill the vegetative forms and that 140° C. [284° F.] is required to destroy the spores; consequently it is customary to heat the oven to 150° C. [302 F.] for one hour to insure absolute sterilization.

Chemicals. Chemicals are mostly used as disinfectants, and are not regarded with much favor as sterilizers. There are several reasons for this. It would be absurd to sterilize or attempt to sterilize media with a chemical which acts as a germicide—germ killing—and which generally is actively poisonous. It would be substituting for bacteria a poison as detrimental as the bacteria themselves. Agents of this kind seldom kill outright, or within several hours, but rather retard develop-

ment, thus making chemical agents impracticable. They, nevertheless, have their use as sterilizers. It is possible to practically sterilize a surface of wood, as the floor, the table, etc., and they are fitted for cleansing walls and ceilings. Metallic surfaces may be purified, and surgical instruments rendered aseptic—free from bacteria producing diseased conditions. These chemicals may not kill the bacteria, but they do prevent their growth, which is a form of practical sterilization. A vessel may be sterilized with chemicals and the chemicals then washed out with sterilized water. Chemical sterilizers fit in where other means cannot be employed. The substances used for this purpose will be considered in another bulletin, which will follow later, taking up germicidal agents and disinfectants for farm use with practical application. Chemicals as absolute sterilizers are of very limited application.

Filtration. By this is not meant filtration by the ordinary filters of charcoal or sand, nor any improvised filter for temporary use. Such filters may be able to remove suspended particles of matter and assist in the oxidation of organic matter, but they will not remove bacteria.

Unglazed Porcelain. There is only one filter that will strain out the bacteria; this is moulded from a fine plastic substance, and is baked at a very high temperature. There is produced an unglazed porcelain. If perfect, the finest particles, not even bacteria, will pass through this filter, but the liquid will, when under pressure; without pressure it would pass through impracticably slowly. To apply pressure the porcelain is made in the forms of long tubes, which are placed in cylinders containing the material for filtration. The top is fitted closely to allow pressure upon the liquid in the cylinder; this pressure forces the liquid through the porcelain into the inner side of the tube, where it is perfectly free from organic particles or bacteria, as the case may be. All the suspended matter adheres to the outer surface, from which it is easily removed.

Filtration of this kind is resorted to in the study of products, formed by the action of bacteria. This filter is also used largely in the filtration of drinking water. For this purpose it is strongly recommended, provided the filters are without flaws. It has been highly praised where it has been used on a large scale in furnishing water to the inhabitants of villages. If India, where this work is in operation, were to make universal use of them, the mortality from Asiatic cholera would doubtless be reduced to a fraction of one per cent.

Cotton wool. For filtration of air in cultural work, ordinary cotton-wool is utilized. This will not free the air of bacteria if a very strong current is forced through. The bacteria apparently lodge in its meshes before reaching the media within. To illustrate what cotton-wool will do in arresting minute organisms, an early experiment with fermentation may be cited. In order to demonstrate the action of yeast plants upon sugar solutions, a tube was filled with a very weak solution of sugar, containing some nitrogenous matter. It was rendered free from bacteria and yeast plants and a sterilized piece of cotton-wool was inserted half way down the tube. The yeast plant was added to the upper half but the lower half was left uninoculated. The upper half fermented and the lower half remained unchanged, showing that the cotton-wool formed a perfect barrier to the yeast plant. It was in about 1854 that it was first used and now it is almost exclusively employed to close culture tubes against infection from the outside.

PREPARATION OF MEDIA.

Up to this point the requirements of bacteria have been given due consideration. The nature of their food has been discussed, and the elements constituting that food; it has also been stated that moisture is an essential feature of the food, and that a suitable reaction is necessary. These are the factors which must enter into the nourishment of bacteria. With these data it becomes possible for the laboratory worker to prepare a medium which will embrace these conditions; but besides the mere matter of a proper nourishment, the experimenter has learned that different species of bacteria produce different growths upon the various media or food stuffs, and this fact he utilizes in identifying bacteria; consequently, certain media have an advantage over other media. The investigator, therefore, strives to provide a medium which will not only answer the requirements of food but also those of a biological character.

Classes. It is customary to divide media into two distinct classes, liquid and solid media. Each has its particular purpose in the laboratory. For the inoculation of animals, the study of bacterial products, and mere cultivation, liquid media are satisfactory.

Liquid Media. When animals are inoculated with bacteria, a syringe is employed which requires liquid media. In the study of bacterial products, a liquid substance is treated more easily. To transplant bacteria with the object of keeping them alive, liquid media, which is readily made, is suitable. While cultural properties are not so pronounced in liquid media, they however have their significance, and in some of these media as, for instance, milk, this feature is very valuable.

There are many liquid solutions which are especially adapted to the growth of bacteria. Milk has been mentioned. More generally

Bouillon. used than milk and better fitted for ordinary work is bouillon. This is owing to its perfect clearness and freedom from sediment; at the same time it possesses nutrient material of the widest range. To make it, one pound of chopped lean meat is shaken in one quart of water and allowed to stand for twenty-four hours or steeped for one hour that the meat extracts and soluble salts may pass into solution. The insoluble albuminous portion of the meat is strained off and to the filtrate is added one per cent of peptones which are soluble and not coagulable by heat. These take the place of the meat that was strained off. One half per cent of ordinary salt is added to facilitate the solution of the peptones When everything is dissolved a suitable reaction is obtained by the addition of some alkali, for the meat solution is usually acid. At this stage the mixture is heated, and boiled for one hour. It should then be clear and the sediment formed may be filtered off. It is now ready to pour into tubes of glass, called test tubes, which have been plugged with cotton-wool and sterilized in the hot air oven for one hour at 150° C. [302° F.]. Having filled these tubes to the depth of one and one-half inch with the bouillon, they with their contents are sterilized in steam heat for fifteen minutes each day for three successive days, as directed under sterilization. At the end of the third sterilization, the bouillon tubes are free from bacteria and are ready for the reception of any species.

Milk. Milk tubes are prepared much as bouillon. The milk is usually employed unmodified and poured into tubes which have been prepared in the same way as those used for bouillon. The steriliza-

tion differs, in that milk requires more time, because of the very resistant bacteria that may be present in it. The bouillon, it will be remembered, had undergone several heatings before pouring it into tubes. The milk on the other hand had been continuously exposed since it left the udder of the cow. One half hour each day for three successive days is necessary for its complete sterilization. Many other liquid media are made for the cultivation of bacteria, but most of them have special objects; for this reason they will not be given consideration.

Solid Media. Solid media have two distinct functions, that of yielding characteristic growths and that of isolating species, both of which will be reviewed later. To accomplish these purposes it is desirable that these solidmedia be transparent and that they will liquify and solidify under certain conditions. Gelatin and agar-agar satisfy the above requirements.

Gelatin. Gelatin is a substance obtained from animal tissues and is used extensively in household cookery. However the gelatin thus used does not answer for bacteriological work which calls for the best silver or gold leaf quality. When this substance is dissolved in water it gives a jelly-like mass; when hot it is liquid and when cold solid. Perfect transparency also exists. It will not be necessary to point out the difficulties to be met in the making of gelatin medium nor state with exactness the steps of the process; suffice it to say what constitutes gelatin medium. It is simply the bouillon with ten or twelve per cent of gelatin added and dissolved. When it has been made properly, it is transparent, solid when cold, and of a suitable reaction. This gelatin will liquify at 24° C. [75° F.]. Sterilization is accomplished the same as bouillon, fifteen minutes each day for three successive days.

Agar-agar. A dried sea weed has been called agar-agar. When placed in water it swells and gradually dissolves. In solution it forms a very hard jelly-like material. Without attempting to describe in detail the process of making, agar-agar may be substituted for gelatin. It yields a transparent medium which will liquify at 85° C. [193° F.] and solidify at 42° C. [108° F.]. This medium is especially adapted to the cultivation of bacteria needing an incubator temperature 37½° C. [98° F.], for which purpose gelatin would not answer. One half hour each day for three successive days is required in the sterilization of agar because of the slowness with which it liquifies.

Blood Serum. Besides gelatin and agar, blood serum is commonly used. This is the clear fluid rising from clotted blood and contains large amounts of albuminous material. That its transparency may be preserved, it is placed in tubes as the other media and sterilized at 60° C. [140° F.] for two hours each day for several days; when it is sterilized, it is subjected to a heat of 70° C. [166° F.] for the purpose of solidifying. It is usually inclined in the tubes to increase the surface and solidified at once. In this case the usual temperature could be employed to sterilize.

Potato. One other medium must be mentioned as a general cultural medium. It is the common Irish potato. This is boiled, cut in cylinders the size of the tubes, then diagonally cut from top to bottom in halves. By this operation a good surface is presented and each half is placed in a tube. The tubes are then sterilized fifteen minutes each day for three successive days.

All of these media, both liquid and solid, contain the necessary constituents for the development of bacteria. Each finds its use under different

circumstances and conditions, and yields a growth peculiar to itself which is studied closely in connection with the biological history of every species of bacteria. They all assist greatly in the diagnosis of species.

PLATINUM NEEDLE.

This instrument is of very common use in the laboratory. It consists of a glass rod in the end of which is fastened a platinum wire of medium size. Platinum is used because it will withstand any number of sterilizations in the flame without destruction. It is employed to inoculate tubes and to convey bacteria from one medium to another. Sometimes it has a loop at the end and sometimes is straight. It may be suited to whatever purpose desired.

HANGING DROP.

It is always very desirable to study a plant or animal in its natural condition. The form, the consistency of the protoplasm, spore formation and motility in the case of bacteria are all best observed as they appear in nature. The form may be studied carefully, with a view to decide the exact classification of the species, the manner of grouping, whether in threads or chains, or other groups, and any variation that may exist in the form. The consistency of the protoplasm evokes much interest in many species. Peculiarities prevail which require close and prolonged investigation, and often lead to results of a particularly practical nature. The spore-bearing bacteria may illustrate their methods of forming spores in their natural condition much better than when stained. All of these features are within the scope

Preparation. of a hanging drop. It is made by taking a very thin, flat piece of glass, called a cover glass or slip, and placing a drop of sterilized water in the center of it, about the size of a pin-head. Into this drop the bacteria which are under investigation are conveyed by the platinum needle. This cover slip is then placed over a hollow in a glass slide, the dimensions of which slide are one inch by three, and the thickness that of a window pane. The drop is turned downward when placed over the circular hollow, and still adheres to the cover slip. This done, the drop is virtually suspended in a glass cell, and to prevent evaporation a little vaseline is spread about the border of the hollow, thus making the cell air tight. It is now ready to study under the microscope.

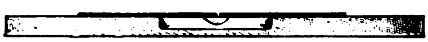


Fig. 15. Hanging Drop.

MICROSCOPE.

The microscope used for the study of micro-organisms is compound and capable of enlarging the object about one thousand times. [It must not be thought for a moment that the more a microscope magnifies the better it is. The real value of a microscope is not determined in this way.] To enter into a discussion of the different parts of a compound microscope and its relation to the study of bacteria would be making a futile effort in this connection. The pur

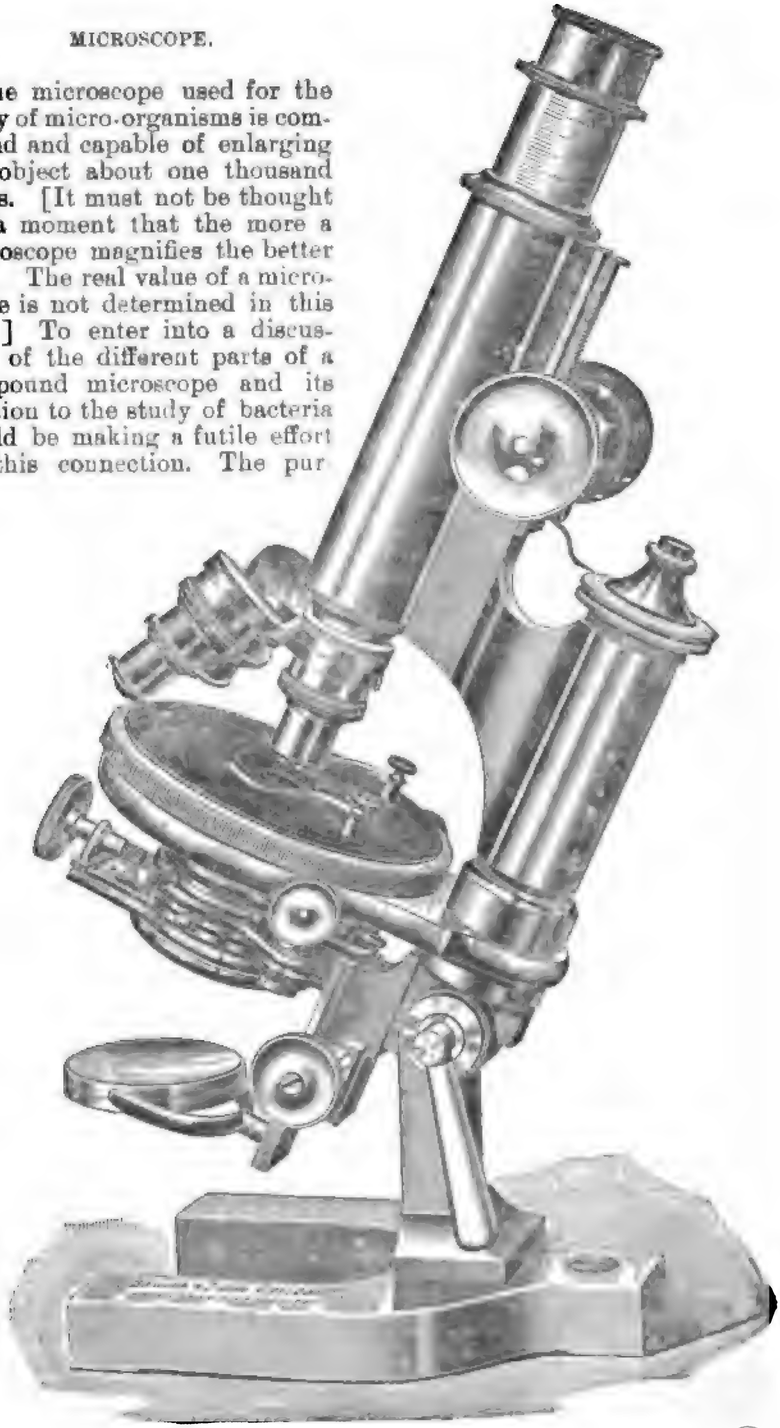


Fig. 16. Compound Microscope.

pose is to state one or two principles underlying it. A lens convex on both sides, or convex on one side and plane on the other will magnify objects. If the double convex lens be used to magnify an object, and another lens to magnify the image formed by the first lens, the object is magnified highly. In figures, if the first lens magnifies one hundred times and the second lens ten times, the image of the object seen through the first lens would be one hundred times as large. Now, if the second amplifies this image ten times, the object seen through both lenses would be increased one thousand times. In this way the ability to see very minute objects becomes possible. The lenses are mounted in a brass barrel, and this is attached to a steady stand. This is the simplest form of a compound microscope. It is through the microscope that the morphological properties of bacteria are made known, and this is the only means available.

STAINING BACTERIA.

In their ordinary conditions bacteria are translucent and many times are very difficult to see. To overcome this obstacle to the proper study of micro-organisms, stains have been called into requisition. They now form a very important part in the biological study of bacteria. The stains used are known as aniline stains, indirect products of coal tar. They correspond to the diamond dyes in commerce and many of them are the same. When desired for use they are dissolved in alcohol to saturation and this solution is diluted with water.

Method. A cover slip is evenly spread with a loopful of material and dried carefully over a flame. By this drying the bacteria are fixed on the cover slip and are thus prevented from washing off. The stain is then applied directly upon the prepared side of the cover slip by means of a pipette and allowed to remain about a minute, when the surplus stain is removed by water. The cover slip is now ready for examination under the microscope.

Special Methods. Besides this simple staining, methods more complex are employed for the recognition of certain bacteria, for the study of peculiarities, and for the satisfactory demonstration of spores and flagella. Some bacteria will respond to one method of staining while others will not, a fact which frequently allows one species to be distinguished from another. The tubercle bacillus is stained by a method to which only one or two others will respond readily. Inasmuch as these others are not likely to be met under the same circumstances as the tubercle bacillus, this method of staining becomes truly diagnostic. At other times there are peculiarities inherent in certain bacteria which can only be sharply illustrated by special stains. In the diphtheria bacillus are peculiarities of the protoplasm which require a distinct stain to determine them. Spores are questionable till they respond to a certain staining reaction. It consists in making a penetrating stain by the addition of carbolic acid. By this means, the spores as well as the vegetative cell may be stained. After the spores are once stained they part with the stain as reluctantly as they took it, but the color is easily removed from the vegetative form; consequently after the spore is stained the color is readily removed from the vegetative form leaving the spore colored and the vegetative form uncolored. An ordinary stain is now applied to the vegetative form which is a contrast to the color of the spore and which will not affect the color of the spore at all. This results in having the spore of one color, say red, and the vegetative form of another color, say blue. A strong contrast of colors therefore exists and the spores are seen distinctly. In the demonstration of

flagella, stains are essential. As in fabrics, substances are employed to fix the stain in the tissue. The flagella are first treated with this fixing solution called a mordant, then followed by an application of a strong staining solution.

INCUBATOR.

Attention has been called to the sensitiveness of some bacteria to a slight variation in temperature. The tubercle bacillus will not develop if the temperature varies over two degrees, and is susceptible to smaller changes. The best temperature at which it will grow is that of the body 37½° C. [98° F]. The same is true of many other infectious bacteria; the pathogenic bacteria as a rule require a suitable temperature. For many other purposes of a technical nature in a bacteriological laboratory, a constant temperature, a temperature that will not vary over the one-tenth of a degree, is required. To comply with these conditions an apparatus called an incubator has been devised especially for bacteriological work. The principle underlying it is much the same as an egg hatcher, but the egg hatcher bears about the same relation to the laboratory incubators that coal tongs do to watch makers' pincers or tweezers. The incubator has double copper walls between which is kept distilled water. Over the whole is placed a thick covering of felt. The doors are double and the outer one is also covered with felt. In the top is a place for a sensitive thermometer, a thermo-regulator and an escape for foul air within.

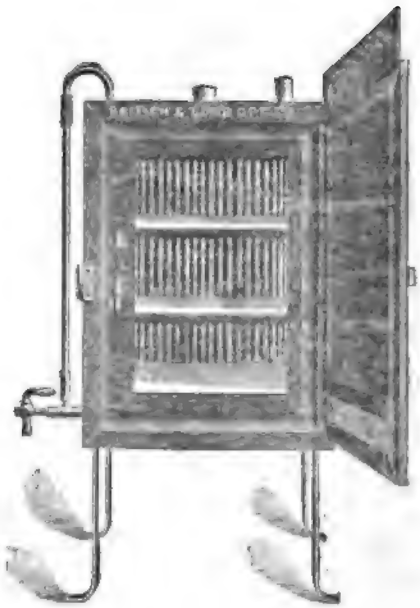


Fig. 17. Incubator.

Thermo-regulator. To regulate the amount of gas supplying the burner, a thermo-regulator has been made. It consists of a tube with arms, containing mercury. Through the arms the gas passes into the tube and out to the burner. There is another adjustment arm which regulates grossly the height of the mercury in the tube. When ready for use one arm is connected with the gas supply by a rubber tube and another with the burner. The tube with its mercury is inserted into the incubator. The mercury as in a thermometer, contracting with the cold and expanding with the heat, operates upon an opening through which the gas passes. When the mercury in the tube has been adjusted to 37½° C., this regulator will hold it constantly at that point. If the temperature of the incubator should fall the mercury in the tube would contract and increase the size of the hole through which the gas passes and thus increase the supply of gas to the flame; if the temperature should rise above

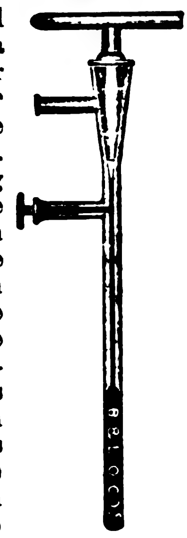


Fig. 18. Thermo-regulator.

$37\frac{1}{2}°$ C. the mercury would expand and decrease the size of the hole and thus decrease the supply of gas to the flame. In this way it is possible to hold a good incubator within a slight variation.

Safety burner. In connection with an incubator is supposed to be a safety burner. The ordinary gas burner could be used to obtain the heating results, but a small draught would blow it out and allow the gas to escape into the room. To prevent this escape of gas if blown out, a spring is attached near the flame; when it is hot it expands and holds up a lever which acts as a stop-cock for the gas; when it cools the spring contracts and the lever falls, shutting off the gas. In lighting the burner, the lever is held up with a catch, until the spring expands and holds it; as soon as the flame goes out the lever falls, when the spring cools and retracts.

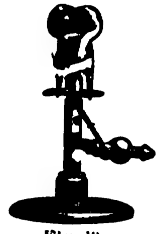


Fig. 19. Safety burner.

CULTIVATION OF BACTERIA.

To isolate and cultivate the various species of bacteria is the object at which we have been aiming from the very beginning of our discussion of laboratory methods. This is necessary for an investigation of their morphological and chemical natures. We are now ready for a systematic laboratory treatment.

The isolation of bacteria is the first step in their study. To do this, the material which is to be examined must always be guarded from outside contamination lest the results be vitiated. Assuming that it is ready, a bit of it is transferred to a liquefied gelatin tube and thoroughly stirred. We will call this tube No. 1. From No. 1, three loopfuls are taken and mixed with a liquefied gelatin tube No. 2; from No. 2, three loopfuls are taken and mixed with another liquefied gelatin tube, No. 3. The object of using three tubes is to dilute the bacterial solutions so that there will be but few bacteria in No. 3 tube. The reason for this will appear as we go on. The tops of these tubes are sterilized in the flame and

Petri dishes. the tubes put aside to cool. Three sterilized Petri dishes are gotten ready. These dishes are round, about five-eighths of an inch high, and four inches in diameter. The bottom fits directly into the cover as the bottom of a telescope fits into its cover, and thus precludes any contamination from outside. The contents of the cooled

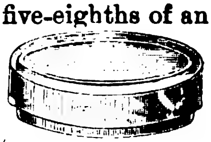


Fig 20. Petri dish.

Plating. tubes are poured into these Petri dishes and spread over the surface of the bottom by the lip of the tube. The Petri dishes are marked Nos. 1, 2, and 3 to correspond with the tubes. This operation is called plating and its purpose is to separate the bacteria and scatter them over a large surface. Each micro-organism

Colony. upon growing will give rise to a mass of its own kind, called a colony, which will appear upon the gelatin as minute whitish

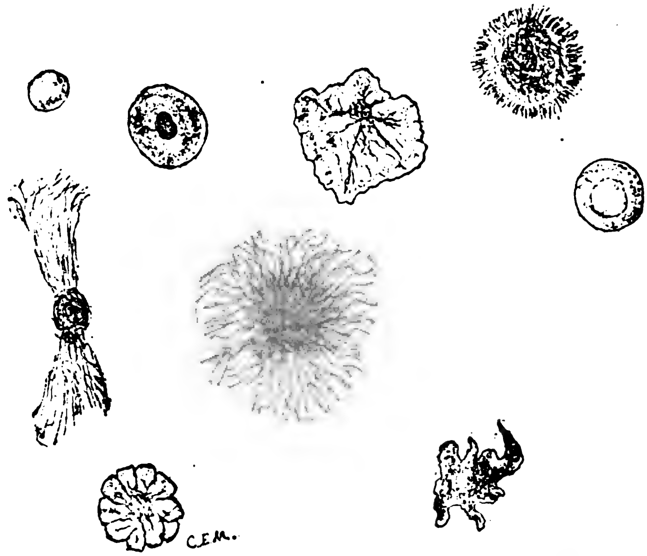


Fig. 21. Colonies.

Counting. spots—pin points. If we wish to count the number of micro-organisms present in one cubic centimeter of water, we would add this amount to a liquefied gelatin tube and make a plate of it as before, using however only one plate and making no dilutions at all. The plate would then be allowed to develop its colonies and these colonies would represent the number of micro-organisms present in the one cubic centimeter of water. If they are very thick we use a hand magnifying glass and place over the plate a piece of glass measured off into small squares. The numbers of colonies included in several squares are averaged. The area of the plate is then computed by the number of squares and multiplied by the average number of bacteria in each square. This will give the entire number of bacteria in the plate and in one cubic centimeter of water.

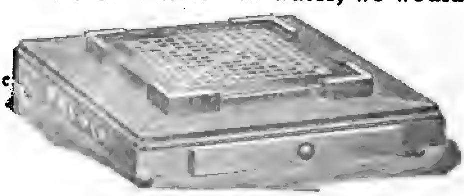


Fig. 22. Counting apparatus.

Cultures. If pure cultures of bacteria are desired the colonies are carefully studied and those presenting different appearances are taken for transplantation. Those having the same characteristics are supposed to have been produced by bacteria of the same species. To transplant, a colony is selected under the microscope and the straight platinum needle sterilized. The colony is watched through the microscope and the wire introduced into it without coming in contact with any other colonies, or with any apparatus, in fact with anything but the colony; for, if it is touched by anything else, it is useless for producing a pure culture. After the colony has been taken up on the end of the needle, it is introduced

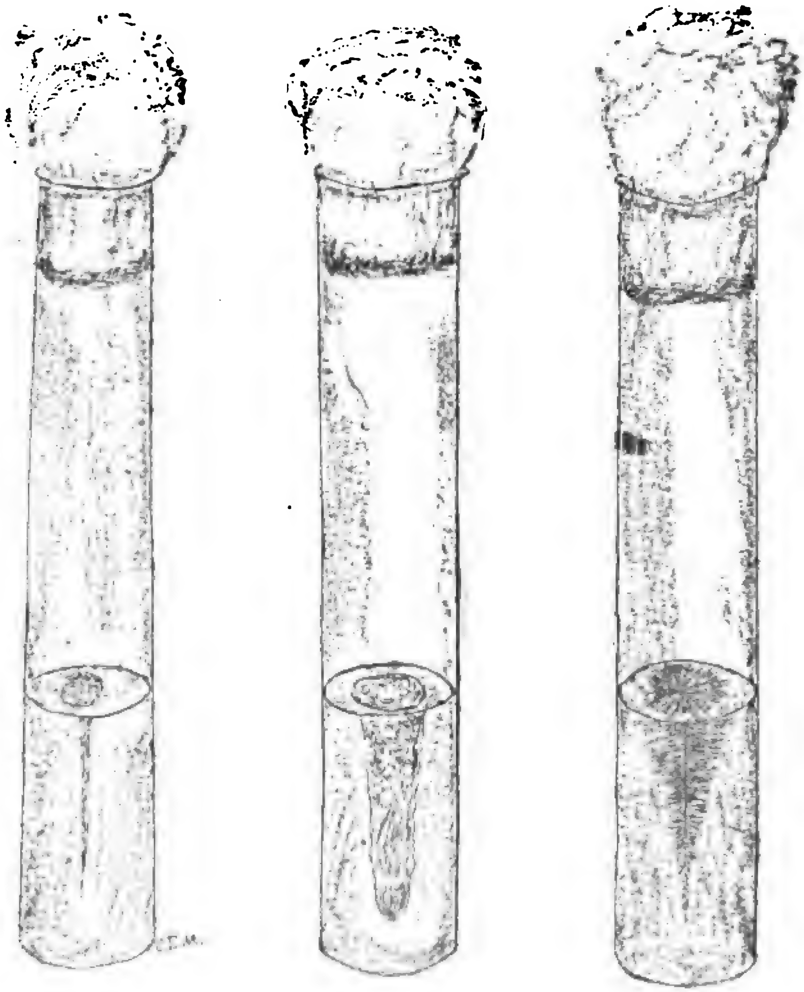


Fig. 23. Cultures in Gelatin.

into a solid gelatin tube, by pushing it from surface to bottom, or into any tube prepared for its reception. This is supposed to yield a pure culture of a distinct species. Each kind of colony is treated likewise, if it is

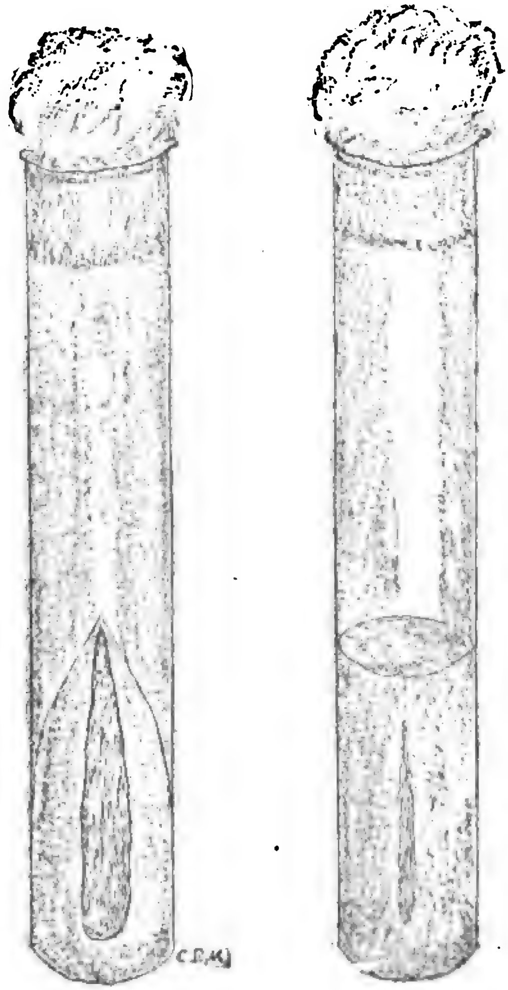


Fig. 24. Cultures in Agar-agar.

desired to study them all. Once in a pure culture we are able to transplant them in all kinds of media for the object of studying their different

growths and chemical relations, and may investigate their morphological properties under the microscope at will.

Anaërobic Cultivation.

Fig. 26. Anaërobic apparatus for tube culture. (Novy.)

What has been said about aërobic bacteria applies to anaërobic bacteria only in part. Everything is exactly the same with this exception: The plates and tubes when made are placed into a jar or bottle, made for this purpose, into which hydrogen or some other inert gas is passed as a substitute for air in which these bacteria will not grow.

Fig. 25. Anaërobic plating apparatus. (Novy.)

ANIMAL EXPERIMENTS.

The use of animals is limited almost entirely to work with infectious diseases. They become in this line of work an essential factor to successful experimentation, because of their power to similate man in pathological conditions. Without these animals it is doubtful whether the relation of the tubercle bacillus to tuberculosis would ever have been established; or the curative properties of antitoxin in cases of diphtheria; or the relief in hydrophobia; or, in short, a knowledge of the various infectious diseases as to prophylactic measures or curative treatment. It is true that many lives of lower animals have been sacrificed for the cause of science, but when we take into consideration the results, we would be very near-sighted if we did not say that it was justifiable. Scientists do not destroy life promiscuously, but with a purpose; and they possess the same dread to take life in the case of rats, guinea pigs, rabbits, and all the smaller animals as those zoophilists who condemn this experimental work while munching a piece of juicy steak.

Animals are also used in the diagnosis of diseases, in the determination of the presence of poisons, and in the study of avenues of infection. They are virtually indespensable to the scientific worker who is called upon to guard the public against danger from unseen sources. Without these lower animals a large portion of scientific work would be at a standstill.

I am indebted to Bausch & Lomb, of Rochester, N. Y., for the electrotypes used in the illustration of this bulletin.

ROPINESS IN CREAM OR MILK.

BY C E MARSHALL.

Bulletin No. 140.—Veterinary Department.

When milk or cream may be drawn out in threads or strings, or when either presents a slimy appearance of a stringy formation, the term, ropy, stringy, or slimy has been given to this condition, designating thereby, a diseased state which prevails to some extent among dairies, factories, and wherever milk is handled. It is, by no means, a new disease; on the contrary, milk analysts have struggled with it for decades, but without positive results. It was not until the biological explanation of many chemical changes was instituted by Pasteur, in his experimental work upon milk, wine, and beer fermentations, and suggested by others previous to him, but not worked out, that such perplexing questions as milk ropiness as well as other milk fermentations could be regarded in a reasonable light. Pasteur was able to say that a certain yeast plant could produce ropiness of milk, yet he failed to comply with the later requisitions of bacteriology in establishing beyond a doubt the exact relation existing between that yeast plant and the milk. Lister was the first to separate a distinct species which would produce ropiness in milk. Since Lister's time many species have been isolated and identified as connected with this peculiar fermentation. Each kind has its particular action. While all may be classed as giving rise to ropy milk or cream, no two of them will produce this condition in just the same way, nor will the milk give exactly the same appearance. Sometimes it is due to the bacteria adhering together in a ropy mass, caused by the secretion of a gum-like substance by the individual bacteria. In this case a string of micro-organisms may be pulled out with the milk or cream, thus rendering their functions only in an indirect way. Such bacteria are not so likely to decompose the milk by the destruction of any element composing it. They, of course, feed upon some of the constituents of the milk, but a change is not likely to occur in the component parts. On the other hand, there are those bacteria acting directly upon the milk sugar in the production of slime or ropiness, consuming a part of that substance. Then there are those whose action is more complicated, involving the other constituents of the milk.

Very frequently in normal milk, that is, milk kept under the usual conditions, bacteria are found which, unaccompanied by other bacteria, will manufacture ropy milk. The other bacteria ordinarily gain the ascendency and perform their functions before the bacteria producing ropiness can manifest themselves. Should the latter gain the ascendency, ropiness would occur and the cases of ropy milk would be multiplied greatly.

Whenever ropiness does exist, it may generally with safety be attributed to foreign and transient bacteria, which gain access to the milk, perhaps accidentally. They sweep down upon a dairy unexpectedly and apparently without a cause; but if the soil, the water, and the air; the cans, the stables, and milk houses could be accurately examined, in fact all those things which surround and have to do with a dairy, the avenue by which they entered would be discovered.

Many countries have been witness to this disease. In Norway, they make use of this ropy milk in the preparation of a drink, called Tättemjolk. The people place the leaves of the butterwort in the milk and the fermentation follows. Bacteria which would give rise to the same condition have been found on these leaves. In Holland, Edam cheese is manufactured from slimy milk. Many cases have been reported from Switzerland and Austria. France and other countries have had their share of this disease. To gain the exact extent of this condition in the United States is impossible. When the information is voluntary and comes from individuals who have been afflicted, reliance can be given; but when the information is sought from dairymen or milk-men, they will evade the question lest it might work harm to them. A few voluntary contributions have been given in "Hoard's Dairyman." These cover about two years and are simply representative of the extent of territory involved and time of occurence. Doubtless a very small fraction of one per cent is represented by these individuals. In most cases, these contributions are in the form of queries and have been reduced to the minimum by eliminating all that has no bearing upon the matter in hand. Whenever the feeding is introduced, it is allowed to remain because it is a common opinion that the feeding is the real cause of the trouble.

The first case was located at Trenton, N. J., and occurred in the summer of 1893, beginning about the middle of July and lasting till about the first of August. The pastures were dry and short during the time. That the individual might ascertain whether the trouble originated from the food or pasture, he tested both and tried each cow's milk by itself, but failed to find the cause.

In October, 1893, a dairyman in Illinois stated that he had been visited by the ropy milk plague, and that it had appeared for a day or a week at a time since the middle of July. At certain periods it was very noticeable, at other times it was hardly perceptible. The whey tank was cleaned and the whey scalded every day; when not scalded it would appear like soft soap upon dipping the next morning. The curd would not cook firmly when the milk was ropy; cheese made from it lacked in flavor and an unpleasant taste was also present, while the keeping qualities were not satisfactory.

A man living near Memphis, Tenn., and running a dairy of forty cows, wrote as follows: "In running my dairy of forty cows, I have been troubled the last week with my milk 'roping.' Please tell me the cause. The cows were changed from a pasture, where there was running water, to one of corn stalks and cotton stalks, where the water was a pond in the field. I am feeding cotton hulls, a chop of corn, oats, and oil meal mixed together. Milk would turn ropy in about twelve hours. I buy corn and oats from a feed store." This happened in January, 1894. Another case was reported from Chillicothe, Mo., in April, 1894, where the milk remained sweet. It was set in deep cans in ice water. A simple query came from Massachusetts, in September, 1894, stating that the trouble existed.

Without commenting upon these cases at this point, I will pass on to two cases which have come under my observation recently. The first case occurred on the farm of Mr. A, located not far from Lansing. He runs a milk-wagon and supplies milk to about three hundred patrons. Fourteen healthy looking cows furnish the milk. Up to the time of the trouble they had been pastured on a low piece of land adjacent to the Red Cedar river, a branch of the Grand. There were marshy places along the shore to which the cows had access and in which, from the appearance, they were in the habit of passing a portion of their time. Through the middle of the pasture was another marshy strip and a very small stream. The remainder of the pasture was good firm meadow land, and contained a large number of shade trees. At milking time the cows were driven through a long lane to the barn, in which they remained during the milking hour only.

This barn was located near the house, and the part in which the cows were milked was on the west side. One door communicated with the barnyard on the south and another with the backyard by passing through a small open shed. Along the west side were numerous windows. The east side came in contact with the main floor of the barn and a silo which had just been renovated and tarred. The floor of the stable was rough and only partly made of boards, being that part where the cows stood, and a dung sink; the remainder was covered with stones.

The milk-house where the milk was cooled in cans was a frame building about ten by twelve feet. It stood in the barnyard about four rods south of the stable. There was one door which opened to the north, but no windows. Matched lumber had been used to cover the inner walls and the ceiling. On the floor was a layer of sawdust about one foot deep which had been placed there the winter before. Back from the middle of the milk-house was a large wooden tank which was filled with water from a well two hundred feet deep and pumped by a windmill.

The barn floor and milk-house floor were occasionally covered over with a layer of lime to purify them.

As soon as the milk was taken from the cows it was strained into cans which were carried to the milk-house when the milking was over, and placed in the water tank to cool; during the cooling the milk was stirred. The milk was again strained after cooling and was then ready for distribution.

These were the surroundings and methods of management at the time the trouble appeared. It was the fifteenth of September when Mr. A first observed it, but it was noticed by three of his patrons on Friday the eleventh of September. No complaints were heard on Saturday, but on Sunday, the thirteenth, there was a universal cry of trouble.

Suspecting that his cows had eaten some plant which would produce this condition in the milk, Mr. A immediately turned his cows into a higher pasture of wheat stubble in which there was a young growth of clover, and awaited an abatement in the trouble. Monday passed but there was no check in the progress of the disease in the milk and his patrons were leaving him.

Tuesday morning a sample was brought to the bacteriological laboratory. This sample was not ropy at the time, but ropiness became apparent by the next morning. There seemed no doubt about the cause of it Tuesday morning; consequently a plan of extermination was laid out which will be considered a little later.

To positively establish the nature of the cause, milk which had been sterilized and freed from bacteria was inoculated with a small drop of the specimen. In twenty-four hours this milk which had been inoculated developed ropiness and was used in turn to inoculate another lot of sterilized milk, and this in twenty-four hours was decidedly ropy. There was no question about what we had to contend with and Mr. A was eager to begin active measures, for on Wednesday so many of his patrons had left him; and, feeling that it was not right to sell milk of this kind, he had stopped his milk wagon. This meant a pecuniary loss to him of one hundred and fifty dollars a month.

Three points of interest were now before us: The first was to eradicate the trouble; the second, isolate the micro-organism; and the third, to locate it.

Our attention was first directed to the cans. In order to render them free from danger, each can was filled with boiling water and covered up; from time to time it was emptied and refilled, until it had been virtually subjected to boiling water for one-half hour. After the cans had undergone this treatment, they were exposed to the direct rays of the sun for the rest of the day. The sawdust on the floor of the milk-house was cleaned out and clean gravel substituted. The walls and ceilings were then washed with a solution of corrosive sublimate made in the strength of one of sublimate to one thousand parts of water. Having done this, three or four pounds of sulphur were burned in the milk-house. The cooling tank was also washed with the corrosive sublimate solution. Nothing could be done to the barn but to sprinkle it with the corrosive sublimate solution and add a fresh supply of lime to the floor. Before milking, the cows udders were washed with the corrosive sublimate solution made in the strength of one to two thousand. The cows were however, finally removed to another barn, before the trouble disappeared.

In attempting to isolate the specific micro-organism, the tubes first inoculated to demonstrate the microbial origin of the cause, had for their purpose also, what appeared to be the most feasible method for isolation. By the production of culture after culture from the cream, it was thought that the "ropy" bacteria would increase in number to such an extent as to reduce the other bacteria present to the least possible number. After repeated cultivation in this manner for some time, plates were made and after they had developed, this micro-organism which turned out to be the specific cause, was very plentiful and there was no trouble in obtaining a pure culture.

Simultaneously with the eradication and isolation of the micro-organism, we tried to locate the source of the bacteria. During the removal of the sawdust from the milk house, a bacteriologically clean dish containing normal milk, which was gotten from a neighbor who had no trouble of this kind, was exposed. At the same time, another dish of milk prepared as the first, was exposed in the barn. Neither of these specimens produced ropy cream. The udders of the cows and the hands of the milkers were then thoroughly washed with the corrosive sublimate solution made in the strength of one to two thousand. The milk from each cow was drawn into an individual fruit jar and a number was placed upon it corresponding to the cow from which the milk was drawn. In the preparation of the cans used for this purpose, the boiling method of sterilization was employed and the tops screwed on, with the usual rubber collar, immediately after sterilization. They were not opened until the milker was ready to draw

the milk into the jar. As soon as each was one-quarter full the top was replaced and the jar was taken to the house for cooling Not long after, they were brought to the laboratory where they were examined from time to time to ascertain whether ropiness was present. Eleven out of the fourteen jars developed ropiness, some sooner than others but most of them within forty-eight hours. To illustrate the care exercised by Mr. A in this experiment and what cleanliness in milking will do, we wish to state that these samples of milk did not sour within sixty hours after milking, exposed to the warm temperature of the laboratory. Not having succeeded in eliminating the "ropy" bacteria by this step, milk was taken directly from the udders of the three cows whose milk first showed signs of ropiness in the fruit jars. It is possible to draw milk from the udder of a cow under an absolutely sterile condition. For this purpose flasks are prepared in the following manner: A 50 cc. Erlenmeyer flask is thoroughly washed and dried. A silver coin milking tube is then fitted to a glass tube which reaches nearly to the bottom of the flask, the meeting of the milking tube and glass tube forming a joint at the neck of the flask, where the cotton wool plug which is used to close the mouth of the flask will cover the joint. A thin layer of cotton wool is then slipped over the milking tube, covering the cotton wool plug and projecting over the lip of the neck of the flask. This is bound down firmly with thread by running it in every direction over the cotton wool forming a network and binding or fastening it underneath the lip. A cap is made to cover the milking tube entirely, extending from the cotton wool plug in the neck of the flask to the tip of the milking tube and covering the tip completely. It is made so firmly that it may be slipped on and off with ease. This outfit was placed in the sterilizing oven for the usual time. When ready for use the teat of the cow is washed with a corrosive sublimate solution, the cap removed from the milking tube, the tube inserted into the milk duct, and as soon as removed the cap is replaced. By following this method, sterile milk may be obtained from a cow if some milk be removed at first from the teat to render the duct free from bacteria. In this instance very little milk was removed before the insertion of the milking tube; but at the end of ninety hours the milk was still sweet and free from ropiness.

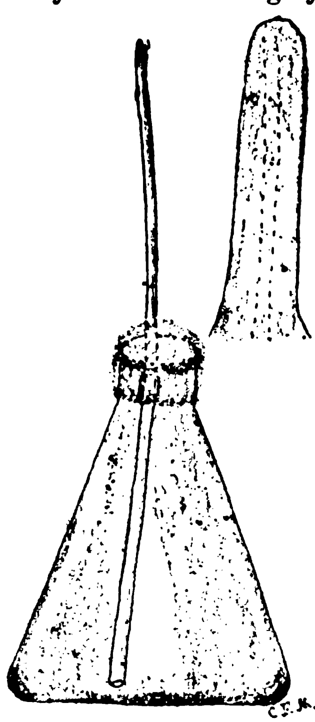


Fig. 1. Flask used in drawing milk.

From the work thus far it would seem that the "ropy" bacteria were located on the udders of the cows; but before taking up the work farther concerning this matter, it is desirable to state the second case that came to our notice.

On Wednesday following the Tuesday when Mr. A brought a sample of his cream to the bacteriological laboratory, a milk dealer in the city of Lansing discovered ropiness in one of his cans. It was confined to this single can and did not spread to the others; all but this can were, however, peddled

out to his patrons. The milk that he handled came from various sources, for it was his practice to buy milk from the farmers in the vicinity of the city. The milk that this single can contained was secured from a farmer living three miles out of the city. A visit to his farm revealed the following facts: The cows were pasturing in a large meadow adjacent to the road and barnyard. Through the middle of this meadow ran a small stream, but that portion of the pasture bordering upon this stream was neither marshy nor very low. From the stream, the meadow had a gradual but pronounced rise and it would not be considered a low pasture land. There was no stagnant water about and the cows usually drank the water provided at the well, yet sometimes refreshed themselves at this small running stream. The milking was done in the open air and in cleanly surroundings. There was no special means of cooling the milk and so far as could be ascertained, it was not cooled at all. It was taken from the cows, placed in a can and carted to the city by the milkman. The farmer had no ropiness at any time so far as he knew, and had not noticed it on this occasion in the milk he reserved. This can which turned out to be ropy was taken to the home of the milkman and placed in his cellar, where the top was removed and the contents exposed the same as several other cans which he had at the same time, and in which ropiness did not develop.

It was about one week after this had occurred that a sample of the cream from the can in question was obtained. The milkman had preserved it. Upon a bacteriological examination by means of plates, the micro-organism producing the trouble was isolated and it proved to be identical with the one which caused ropiness in the milk of Mr. A. Its biological history corresponds precisely with that micro-organism which manifested itself on Mr. A's farm four and one-half miles away.

It was readily inferred that there must have been some means of communication. Close questioning could establish no possible clue, for they all claimed to have had no interchange of cans or milk within a month or two of this time. Failing in this, I turned my attention to the water found in the pastures of both farms, although the streams were not the same, both however flowing into the Grand river. A close bacteriological examination was made in each case but without any positive results. Another investigation was made of the air of the milk-house, barnyard and stable and this too failed to reveal the source of this micro-organism. Plates were exposed under the udders of the cows while milking and these added nothing to our knowledge.

The infection had about disappeared when the last investigations were made. Owing to their negative nature, we were forced to the conclusion from our first work when the trouble was at its height, that the infection came through the cows and that the bacteria were adherent to the udder. This was demonstrated almost beyond a doubt by the can or pint jar experiment and the flask experiment where the milk was drawn directly from the udders. How these bacteria happened to locate there and whence they came are still unsolved problems. What avenue of communication existed between the two farms and what they have in common are yet unknown. This class of bacteria may be found in the air, water or soil, but at present it is not determined in which this one may live.

CLIMATIC CONDITIONS.

With the data now given, the climatic conditions may be profitably considered. In all of the cases in the northern states reviewed at the begin-

ning and the two cases studied in the body of the work, the time of occurrence was between the middle of July and October; wherever ropy milk has prevailed, there is generally accompanying it a condition of the atmosphere which is peculiarly significant. No season of the year is better suited to the rapid development of bacteria than the time mentioned. The air is more or less saturated with moisture, and the temperature is high. This is the period of "dog days," and the air is muggy and oppressive; it does not differ much from the condition of the atmosphere just at the beginning of a thunder storm. Associated with this season is the phenomenally rapid souring of milk, and the large amount of decomposition in process. Algae are abundant in stagnant pools, and water everywhere seems to be teeming with life. It is almost impossible to preserve anything in a fresh state. As soon as the cool October weather creeps over our northern states, the conditions which favored the development of bacterial life have been changed, and the ropiness of milk or cream disappears with them; yet it is possible to have stringy milk in the winter season. Such cases would necessarily be rare, inasmuch as the temperature is so low as to retard their growth, and thus prevent any chance of their manifestation. In the south, where they are often visited with the trouble, even in the winter, the conditions are much different. There they may have the best opportunities for bacterial growth during the winter months. Bacteria, like the higher plants, have their season of greatest activity, and must be especially guarded against at this time, if trouble is to be avoided. They are more likely to be prolific and bold, for whatever they enter has a suitable temperature and moisture to aid them in their multiplication. The water is warm in the streams and lowlands, the soil is fit for their reception, and as soon as they find a vehicle of conveyance they travel from place to place. If they establish themselves in a dairy, barn, pasture, or house, there they will ply their depredations with vigor while the moist and hot summer weather lasts, and can be eradicated only by persistent efforts.

TREATMENT.

In the treatment of a bacterial devastation of this kind, many things which are now common to readers can be emphasized only. Since bacteria may find their way into the milk from the air, the lower portion of the cow, the milker, or the cans, the plan of extermination may be arranged accordingly. Although the air does have bacteria which may be detrimental to milk, yet it cannot be regarded as the most important factor. Since it may be a source, it must always be considered when the bacteria are to be eradicated, by ascertaining whether it makes any difference to change the cows to another barn or to milk them in the open air. Take the milk from the milk-house or pantry for a short time to see whether the trouble will disappear. By changing the air conditions and evironments, it may be possible to stop the evil at the start. If the air of the milk-house should be the carrier of the bacteria, it may probably be traced to dust arising from the floor or elsewhere, and would point to a thorough cleansing of the place. This can be done by first removing any dirt that may be about and then following with strong disinfectants. Wash the floor, walls, and ceiling with a solution of corrosive sublimate made in the strength of one part of corrosive sublimate to one thousand parts of water. Use this freely on all the woodwork, shelves, tables, and wherever it will not come in contact with metallic substances or utensils used in the dairy.

After this has been done, burn three or four pounds of sulphur to every one thousand cubic feet of air space. This may be done most effectually by closing all possibilities of escape and placing the sulphur in an iron vessel which rests upon bricks in a tub of water. To start it add a little alcohol. Allow the process of fumigation to continue from forty-eight to seventy-two hours. Any room or building may be rendered fit for use in this way. If it were a stable, a thorough scrubbing of walls, ceiling, and floor, with a few days of airing, would be all that could be done. Whenever whitewash can be used after the washing, it makes a good accessory.

To cleanse the lower portion of the cow, it would be well to clean off the thickest of the dirt in a dry state, then wash off with a solution of corrosive sublimate made in the strength of one to two thousand of water. Allow this to dry sufficiently to insure against any of the liquid dropping into the milk. The udders gather bacteria from the soil of the pasture, weeds, straw, water in which the cows may stand and from the soiled condition of many stables. Doubtless most of the bacteria which find their way into the milk enter by way of the udder. In the eradication of bacteria, the udders must be washed thoroughly among the first steps taken.

The hands and clothes of the milker have their significance, but unless infectious diseases are about, there is little chance from regular inoculation with bacteria of a detrimental nature. It is best, however, to have the milker wash his hands in a solution of corrosive sublimate made in the strength of one to one thousand, when there is trouble of a bacterial nature.

There is nothing so essential as a thorough cleaning of the milk pails and cans. When once harboring the bacteria, unless they are made absolutely clean, they will be a continuous agent of inoculation. Milk vessels should always be boiled for one-half hour after every milking when ropy milk exists in the dairy, and this should be followed during the presence of the trouble, for as long as it exists, the vessels will be contaminated and of course these injurious bacteria must be killed.

If it is impracticable to place the cans and milk pails in a boiler, boiling water could be utilized by filling the can with it and keeping it hot by a renewal every few minutes. This process of sterilizing should continue for at least one-half hour.

THE BACILLUS CAUSING THE TROUBLE.

Morphology: The length of this bacillus averages about two micromillemeters and the thickness is one and one-fourth—a very short thick bacillus. It is usually arranged in pairs and may be either single or grow

into threads of four, five or six. The ends are round and the protoplasm homogeneous in all of its stages of development. When forming in threads, it is impossible to distinguish the individual bacilli; they frequently resemble a single long bacillus.

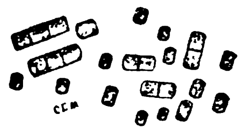


Fig. 2. Bacilli of ropy cream.

Colony: The first appearance of the colony is round with a well defined and even border, having a blackish brown color and finely granular contents. Upon studying the plate, the largest number of colonies will present this aspect. There is no liquefaction which causes the colony to sink into the gelatin, but the surface colonies rest on and rise above it. Continuing to develop, the colony sends out from its border a thin and light colored plaque with a border not so well defined and somewhat uneven, simply a thin layer of micro-organisms spreading from the main body of the colony over the surface of the gelatin Again from this thin layer, as the colony grows older, another layer starts thinner than the one from which it proceeds and is almost void of color, translucent. The border is still less regular and almost ragged; sometimes it has a scalloped appearance. To the naked eye, the colony glistens and gives a rounded oval surface. Upon the application of the platinum needle, the colony will often adhere as a whole; at other times a ropy mass of bacteria will be drawn out. From this will be inferred the tenacious secretion of this bacillus.

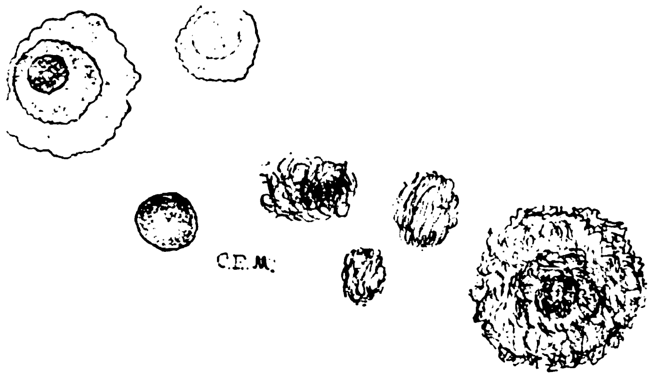


Fig. 3. Colonies of ropy cream bacillus.

After cultivating this bacillus for some time and plating it in the same gelatin, it was found that the colony had undergone a marked transformation, and in this state gave a loose patch work in its younger stage and a very irregular colony as it matured.

Gelatin Stick Culture: There is a slight growth along the line of inoculation, in some tubes simply a beaded development, in others quite a

continuous growth appears, but it is confined to the puncture. On the surface, a moist glistening white mass is seen about the point where the needle entered the gelatin. The borders are somewhat irregular. The extent of the growth is limited to a very small surface and resembles a large colony which is not inclined to spread. In holding it to the light, an iridescent hue is revealed.

Agar Streak Culture: Along the entire streak and extending but a very short distance from the streak, is a whitish slimy and glistening growth with a scalloped border. The development is very rapid.

Potato Streak Culture: On the surface of the potato, it produces a yellowish white, creamy growth which rises above the surface and is confined to that portion inoculated, with no tendency to spread.

Bouillon Culture: At first the bouillon becomes cloudy and eventually a scum forms over the top. When the needle is applied to this it is possible to draw out a string several feet long and so fine that it is virtually invisible. As the culture becomes older, these bacteria form a jelly like mass in the bouillon and the bouillon itself responds as jelly. It is a difficult task to break up this mass by the addition of more liquid.

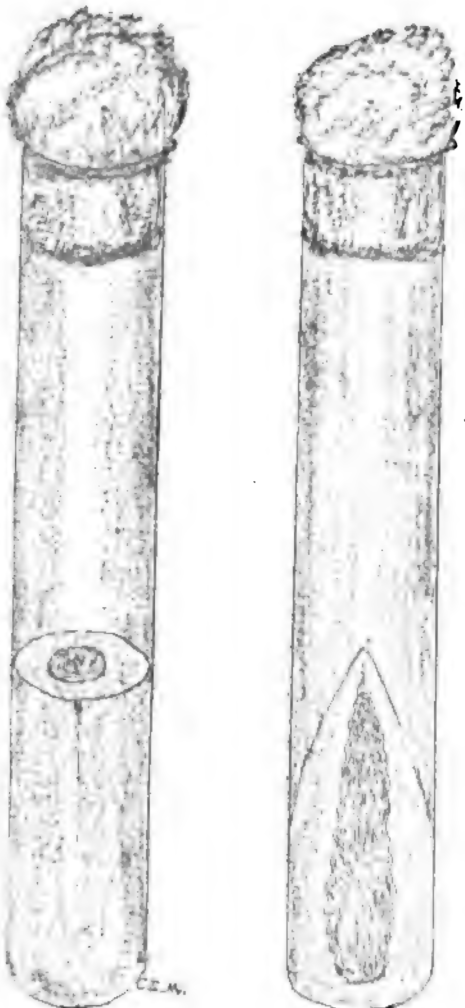


Fig. 4. Gelatin and agar tube cultures of ropy cream bacillus.

Milk Culture: When bacteria produce any peculiar condition of the milk, as the formation of lactic acid, butyric acid and other products, the investigator attempts to determine that constituent of the milk from which any one of these products is formed. In the lactic acid fermentation, the sugar of milk will gradually disappear until a certain per cent of acid is formed. Inasmuch as stringy milk may be produced from the sugar of milk or some of the protied substances, as caseine, it therefore becomes an interesting feature of the life history of this class of microorganisms to study their action upon the various component parts of milk. Although the cultured properties of the bacillus in question indicate whence comes this ropiness and preclude any further analysis, to settle the matter definitely an estimation was made of some of the substances constituting milk. This was carried out as follows: Flasks of milk were sterilized after the usual method, and were inoculated with the bacillus.

They were put away for three weeks, at the end of which time no apparent change had taken place, but ropiness existed. The caseine was then precipitated and found to equal the usual per cent, estimated in connection with the coagulated albumen. The amount of sugar was also ascertained to be normal. Judging from this work, the bacteria evidently feed upon the milk without producing any preceptible change, unless the change is so slow that a much longer time would be required.

The acidity was studied by taking two lots of the same milk which had been sterilized and treated together, and adding to one the bacillus and keeping the other as a control. The examination showed that the amount of acidity was not increased but very slightly decreased. Several repetitions gave the same results. In connection with this, work upon a number of slightly acid bouillon cultures demonstrated that the acidity was reduced. So far as it was possible to test it, the secretion of the bacilli was alkaline, but this is not positive since it is quite possible that foreign material might have been present to influence the reaction. No odors were perceptible in any of the media. This fact is quite significant in the study of any decomposition.

Butter: The work in connection with the butter I owe to Mr. G. H. True of this station. Separator cream was employed in two lots of equal amounts. In one, the bacillus was introduced in large quantities; in the other, the bacillus in the same quantities was not introduced until it had been Pasteurized at 70° C. for twenty minutes. Both lots were then placed away and allowed to ripen for twenty-four hours, when they were churned.

The loss of fat in the butter-milk was 2.2% in the case of the un-Pasteurized cream and 2.8% in that of the Pasteurized cream. The acidity of the Pasteurized cream was .27% and of the un-Pasteurized .57%. The time required to churn the Pasteurized cream was seventeen minutes and the un-Pasteurized cream twenty-seven minutes.

It will be seen that considerable butter-fat was lost. This was doubtless due to the holding of the fat globules in the adhesive secretion of the bacteria, for if the fat globules are once embedded in this material, it is extremely difficult to liberate them. The difference in the acidity is doubtless due to the fact that where the cream was Pasteurized, most of the lactic acid bacteria were destroyed, consequently the conditions usually present and favorable for the growth of lactic acid bacteria were changed. In the un-Pasteurized cream this class of bacteria performed its usual function. The difference in the time of churning is very noticeable. It is either due to the Pasteurization of the milk or to the action of the bacteria of ropy milk upon that substance which holds the fat globules. There is nothing, however, in the biological history of this bacillus which would indicate any such peptonizing action, yet I am not ready to say that it does not exert some influence upon the cream.

The flavor of the butter was not improved in the case of the un-Pasteurized cream and when it was Pasteurized, the butter produced was insipid to the taste. No peculiar aroma was present.

Temperature: This bacillus grows best at about 30° C. It is killed at 60° C. for twenty minutes. Freezing it for three hours has no influence whatever upon its vitality, and when it is transplanted, the development is as rapid as though it had been cultivated under the most favorable circumstances.

Motion: No real motion can be discerned; a slight Brownian motion is perceptible.

Stain Reaction: Responds very readily to simple aniline stains.

Spores: No spores could be detected.

At the time of going to print I find that this bacillus has lost under artificial culture a large part of its power to produce ropiness; it has also decreased in vitality, and in rapidity of growth—it now grows slowly and less exuberantly.

FORAGE PLANTS AND WHEAT.

BY A. A. CROZIER.

Bulletin No. 141.—Farm Department.

I. FORAGE PLANTS.

ALFALFA.

Although alfalfa is especially adapted to dry soils and climates it readily responds to an increased supply of moisture, if the soil be sufficiently rolling or open to carry off all standing water. During the season of 1896 the small fields of alfalfa on the college farm, one of half an acre, the other of two acres, were each cut four times, the largest yield in each case being the first. The first cutting was made May 23, and the last October 12. The smaller field was seeded in the spring of 1892. A portion of this field on low black soil, gradually killed out during cold winters, and the remainder is now crowded somewhat by June grass, which formed a considerable part of the first cutting but not of the later ones. The other field is located on the high bank of the Red Cedar river, and was seeded in the spring of 1895. Part of this piece has a heavy soil, while that of the remainder is a coarse sand of low fertility. The alfalfa was a good stand over the entire piece, but on the light sandy soil it made, both last year and this, an extremely small growth. The entire yield in hay cannot be accurately given, since a portion of it was put in the silo and the last cutting, made from time to time from September 26 to October 12, was used for feeding green. The entire product was weighed, however, and amounted to 5,496 pounds of hay and 9,742 pounds of green fodder, the total, estimated as cured hay (reckoning one-half the green fodder as hay), amounting to a little over 10,367 pounds, or five tons of hay for the two acres. Since a large portion of the piece was poor and unproductive, nearly half an acre at one end, where the soil was heavy and the growth much better, was kept separate at each cutting and gave yields per acre as follows:

Cutting.	Date.	Yield.	Estimated as hay.
1st	May 23	6,654 lbs., green	3,327 lbs.
2d	June 29	1,034 " hay	1,024 "
3d	Aug. 17	3,071 " hay	3,071 "
4th	Sept. 26-28	5,010* " green	2,505 "
Total			9,937 lbs.

* This was at two cuttings, at one of which the fodder was wet with rain. From the weight of this cutting one-third was deducted for water.

The above shows a total yield on this part of the field of nearly five tons of hay per acre for the season from the four cuttings.

As further evidence that alfalfa requires good land, the following letter is presented from Mr. J. W. Pennel, of Grand Rapids, Mich. Mr. Pennel has sown a large amount of alfalfa seed during the past two years on sandy soil near the city mentioned. He says: "My experience with alfalfa on my soil is that where the ground is in a high state of cultivation it does well, but where the ground is lean it takes too long for it to get to be a paying crop. I sowed most of mine with winter wheat. Where the ground had been manured it got large enough to mow this fall. Last year after wheat harvest I plowed my door yard and sowed it to alfalfa in August. This year we mowed the piece three times. Where the ground is rich I think alfalfa a very paying crop, but where the ground is poor I prefer other clovers and grasses."

QUESTIONS ON ALFALFA.

The status of alfalfa, either as a forage or fertilizing crop, in Michigan, is far from being settled. A considerable amount of the seed has been sown during the past two or three years, owing to the failure of clover, but reports as to the results are quite conflicting. There is evidently lack of information in many cases as to the best methods of managing the crop, so that many unnecessary failures have occurred. Below are a number of inquiries that have been received regarding this plant, following which is given a condensed abstract of our replies.

Sholes & Downer, North Branch: Will you kindly let us know what experience you have had with alfalfa this summer, and whether you think we will be able to do anything with it in this State?

J. M. Halstead, Bay City: I, like others, have lost my clover and feel like inquiring for something to take its place. Have you any work on Lucerne? If so I would be glad to get it or to get your opinion of its success in the Saginaw Valley.

B. J. Hansner, Ypsilanti: I have a piece of sandy ground that is now in wheat that I intended to seed to clover this spring. How do you think alfalfa would do in our part of the country? Would it be a good way to sow it in the spring on wheat and drag it in?

Thomas W. Harris, Wayne: Can I sow alfalfa on my rye ground, and can I sow it with timothy on oat ground with any hope of success? How much ought to be sown to the acre on light sandy soil?

J. H. Wetmore, Cheboygan: Can you give me some information about alfalfa as to price of seed, how soon a crop can be grown, whether the year of seeding, and if it is a good crop on light soil, also where seed can be bought at a reasonable price?

J. W. Robinson, Vestaburg: Kindly advise how and when to sow alfalfa seed on high and rolling loamy land. I desire if possible to sow on fall grain, either this fall or next spring.

A. E. Bailey, Marcellus, Editor Marcellus News: One of our readers brought in some samples of clover—alfalfa, I believe—and asks for what information he can get on the subject. He raised it on high ground, found that it withstood dry weather remarkably well, and with his limited experience was more than satisfied with it. When should it be sown, on what kind of soil, etc.? I have but recently taken hold of the News and have not had a chance to become posted on your bulletins on the subject.

R. McElwain, Hickory Corners: I have a small piece of ground that I wish to sow to alfalfa if reports are true as to its yield—three crops in a year, some say. The ground is a rich clay loam—is the soil all right? I had thought of sowing it as I would a crop of oats. What amount do I want to sow to the acre and when should it be sown? If sown in early spring would I get any feed that year or could it be mown during the summer?

D. S. Young, Armada: I have been experimenting this summer with an acre of alfalfa. I sowed half a bushel to the acre after oats. When I cut the oats the clover stood about two feet high and very thick. Since the oats were cut the clover has made a nice growth, and now looks splendid. It is growing on quite a heavy subsoil. When should I cut it for seed, the first or the second crop?

Mrs. Ella Kinsman, Eastman: I have a farm in Shiawassee county upon which are twelve acres of ridge consisting of rich gravelly soil which dries out very quickly so that it is almost impossible to get a good catch of clover. It becomes so dry in July and August that the clover dies. It is now seeded to winter rye. Is it advisable to sow alfalfa upon this ground, and can it be sown on the rye this spring as we would June clover?

Frederick Shepfel, Rothbury: I want to raise a piece of alfalfa (Lucerne) for my horses. Some of my German neighbors claim that where they came from in northeastern Germany it is raised for that purpose, and they cannot see why it cannot be raised here in Oceana county, which has about the same climate. They say that in their country two varieties of Lucerne are raised, one variety for clay land and another variety adapted to sandy land; and they say they would like to buy seed of the sandy land variety if they knew where they could get it. Please send me a bulletin, if you have one, on alfalfa; if not please send information.

ANSWERS.

To begin with the last question, we have made inquiries in regard to varieties of alfalfa adapted to different kinds of soil, but as yet without success.* That some variation exists in the alfalfa plant as grown in

different portions of the world there can be no reasonable doubt, but such variations have not, so far as the writer is informed, amounted to well marked varieties. It is said that the Chilean alfalfa, which was introduced into California, and which is now the stock chiefly grown in the United States, is more vigorous and deeper rooted than the alfalfa previously grown in the eastern United States, but I am not aware that a careful comparison has been made. In the spring of 1895 the following samples of alfalfa seed from different sources were sown side by side upon the station grounds.

1. *Seed grown in France.* Plants of about average size and vigor.

2. *Seed grown in Germany.* Decidedly the best row in the series. Row taller, broader, fuller, and more even than any other, and earlier to start in the spring.

3. *Seed grown in Colorado.* Nearly as good as No. 1, and superior to it later in the season—somewhat uneven. A few seeds ripened the first year.

4. *Seed grown in Armenia.* This seed came from the World's Fair at Chicago. The amount was small and it was sown thinly. In general appearance this row stood next to No. 2, starting in spring a little slower and appearing more uneven. In July, however, it stood taller than any other row in the series, and had it been sown as thickly as the others it would, perhaps, have surpassed them all in yield.

5. *Old College seed; source unknown.* This gave decidedly the poorest results of any. The seed had been kept in the college seed room for some ten years or more but there was nothing to show where it came from. The seed germinated fairly well in a tester. The plants in the field however were much less vigorous than any of the other samples, and the first year matured a considerable amount of seed. The next year, 1896, this row started more slowly in the spring than any of the others and remained somewhat behind them all summer. None of the samples matured seed this year.

The above results indicate that the source of the seed is a matter of importance, and they seem to emphasize especially the value of fresh seed.

The remaining questions asked above have most of them been answered in Bulletin 125 and in a special circular on alfalfa. They may be briefly recapitulated, however, as follows:

1. Climate. Alfalfa is grown most extensively in warm, dry climates and produces in such a climate its largest yields, especially if subjected to irrigation. It is hardy, however, in any part of Michigan and is injured in winter only on heavy wet soil where, like clover, the roots heave out.

2. Soil. Any good soil will answer except muck. If the soil is heavy it should be rolling or well drained.

3. Amount to sow. Twenty pounds of seed to the acre is the amount usually sown. On heavy soils, or if sown with grain, a somewhat greater quantity should be used.

4. When and how to sow. The best results are obtained by sowing in the spring without a grain crop, though sometimes sowing with grain

*There is, however, a plant grown in Europe on poor sandy soil called Sand Alfalfa or Sand Luzerne which has sometimes been called a variety of the ordinary Alfalfa and sometimes a distinct species, *Medicago media*.

has proved successful. Alfalfa is particularly sensitive to drouth in its early stages of growth, so that unless the season or the soil be unusually moist it is apt to be killed out by the growing grain. Fall seeding usually winter kills in this State.

5. Result the first year. No crop can be expected the first year. If weeds appear they should be mown before seeding, and with the young alfalfa, be allowed to lie upon the ground. If the growth is excessively heavy however it should be removed.

6. Will it take the place of clover? Not unless there is a decided failure of the clover crop. In very dry seasons alfalfa does better than clover. It is also exempt from the root borer. It starts earlier in spring and grows somewhat later in fall than clover and remains green during the dryest months. It will yield during the season as much or perhaps more than clover but requires several cuttings. It cannot be as safely pastured as clover, owing to injury to the plants by the trampling of animals and by close grazing. There also seems to be need of greater caution in pasturing alfalfa than of clover to prevent animals bloating. Alfalfa hay, though somewhat coarse and woody, is readily eaten by all kinds of stock, but in curing the hay care is needed not to over dry it or there will be a great loss of leaves. Alfalfa is more particular than clover in regard to soil and will not thrive as well as clover on poor sandy land.

7. The seed crop. So far as known alfalfa has not yet been raised for seed in Michigan and little information can therefore be given on this point. It is not certain that the seed can be successfully raised in this State in ordinary seasons, as the blossoms often fail to set. In Colorado the plant seeds abundantly and the second crop is usually cut for that purpose.

8. Price of seed. Where alfalfa seed is grown the yield is greater than that of red clover and the price from first hands is usually less. In some seasons it is so low that the seed is used for feed. In eastern markets the price is usually about the same as that of red clover. The seed is sold by all seedsmen and by most dealers in farm seeds in the smaller towns.

KAFFIR CORN.

Recent favorable reports, chiefly from Kansas and Oklahoma, have called attention to the merits of Kaffir corn as a grain and fodder plant well adapted to withstand drouth. In certain cases in the state and territory mentioned its yield has been greater than that of Indian corn. Last spring the seed was widely advertised by seedsmen and the plant received extended favorable notice in the agricultural press. From various parts of this State have come to the station inquiries as to its value and the method of its cultivation. The following statement from Farmers' Bulletin No. 37 of the U. S. Department of Agriculture, written by Professor C. C. Georgeson of the Kansas Agricultural College, expresses well its agricultural features:

"Like all other crops, Kaffir corn yields best on rich land. It responds well to generous treatment. Its culture, however, is not limited to soils of certain classes and qualities. It may be grown on stiff clay and on light sand, in river bottoms and on poor uplands, and it will yield profitable returns on soil too poor for corn. Perhaps the strongest recommendation

of Kaffir corn lies in the fact that it will produce a crop on less rain than is required for corn, and that it is not affected so disastrously by hot winds. It is therefore especially adapted to the semi-arid west, where corn succeeds only once in five or six years because of hot winds and drouth."

In 1895, a season of most intense drouth in Michigan, a plot of Kaffir corn on the college farm, on a poor sandy ridge, withstood the drouth better and produced a much larger growth of fodder than an adjoining piece of field corn. During the past season, which was one of abundant rainfall, half an acre of Kaffir corn was grown on good heavy soil in a series of half acre plots devoted to various forage crops. Adjoining the Kaffir corn on one side was a plot of early amber sorghum and on the other side a plot of Salzer's fodder corn, a large, rather late variety of white dent. The yields from these three plots, weighed green as soon as cut, were as follows:

Dent corn	15,354 pounds.
Kaffir corn	17,180 pounds.
Sorghum	19,338 pounds.

The Kaffir corn was the latest of the three and was allowed to stand until there was danger of its being killed by frost. It was cut September 22, the Dent corn and sorghum having been cut September 2. The three crops were at about the same stage of maturity when cut, none of the seeds having fully matured. The soil on which these crops were grown was a little the best on the sorghum plot and poorest where the Dent corn was grown. All three crops were planted thinly in drills, the same distance apart, and made an excellent growth.

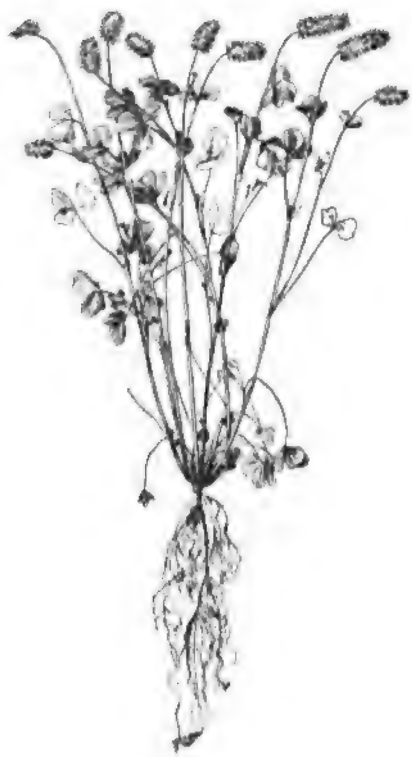
Kaffir corn is one of the sorghums which is not adapted to making sugar. The seed is produced in a rather loose head at the top of the stalk. The plant matures too late to be a safe crop for most parts of Michigan, but for rather poor light soils in the southern counties it may prove of some value.

CRIMSON CLOVER.

As stated in a press bulletin issued in May, crimson clover sown in 1895 came through the following winter better than usual. The present season has also been exceptionally favorable for this crop. Spring sown crimson clover, which heretofore has usually been a failure, or nearly so, has this year made an excellent crop. One field of half an acre, sown with oats, came on after the oats were cut and by the middle of September had a thick, uniform stand two feet high and was in full blossom. This piece was cut for green feed Oct. 23 and Nov. 12, yielding 5,134 pounds, as it was drawn from the field. In a few spots the plants were dead or dying when cut. Another similar piece was sown without grain and grew rapidly from the start. It was cut June 24, while still very green and succulent, yielding 1,870 pounds when green and 418 pounds when cured. After this cutting it came on and produced a second crop upon which sheep were pastured for about six weeks during August and September. After the sheep were removed it made another small growth and entered the winter in promising condition.

In March last there was begun the experiment of sowing a tenth acre

plot each of crimson clover and red clover every month. Both clovers were sown at the same dates in adjoining plots the last day of each month. The complete results cannot be reported until next year, when the experiment is finished, but the condition of the clovers up to this time (Nov. 1, 1896), may be briefly noted. On the whole the yield of crimson clover up to the present from these plots is apparently somewhat greater than that of the red clover; its growth is not so tall, but it is thicker. The March crop of crimson clover matured a crop of seed early in August, but the plants instead of dying thereafter, as in previous



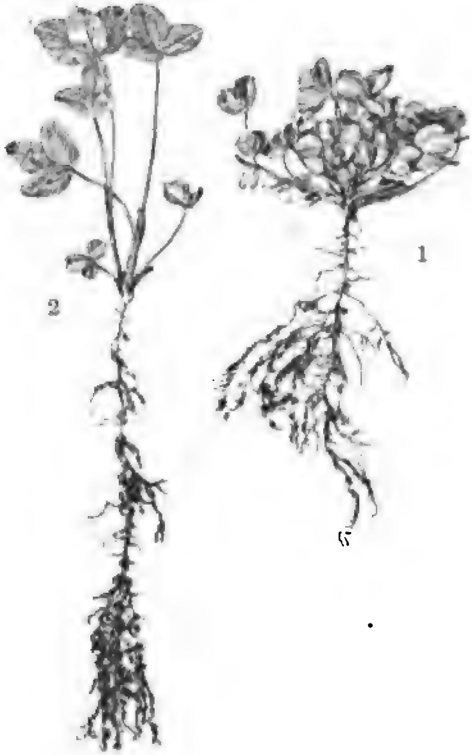
CRIMSON CLOVER.

years, continued to put forth blossoms until checked by the hard frosts of autumn. Late in October nearly all the plants on this plot died. The April plot did not seed so abundantly, but the plants which seeded freely died at the same time as those in the other plot. The plants which produced little or no seed remained green and thrifty. The plot sown the last of May produced only now and then a blossom head and entered the winter with a thick mass of verdure about eight inches deep. The later sown plots were of successively smaller growth as the season advanced. The plots sown after the first of August made so little growth, that judging from previous experience they are not likely to survive the winter.

NEW MILLETS.

In the report of the station for 1895 is an account of three varieties of millet from Corea, the seed which was sent by Hon. J. M. B. Sill, U. S. Minister to that country. Later in the same year four additional samples, described below, were received from the same source: They were planted May 20, 1896.

No. 1. *Sorghum.* "Grows high like sugar cane. Used for sweetening and in candies, for which purpose only the seeds are employed, these being boiled and the syrup used. The plant is used for fuel and thatching, but not for forage. The juice is not sweet. The heads resemble broom corn, and are occasionally used for short brushes after the seeds are removed. The seeds are bitter and not eaten."



1. Crimson Clover. 2. Red Clover. Each six weeks from seed.

Only a few of these seeds germinated. The plants were rather feeble on the start, but grew with vigor later, and became taller than any other kind of sorghum on trial. The plants have a general resemblance to early amber, but are larger and taller, and the head is large and looser. The seeds failed to mature.

No. 3. *Panicum miliaceum.* (No. 2 was Sesame and is omitted here.) "Height about three feet. Seeds eaten with glutinous rice; also made into

cakes after crushing and cooking. Plant used for the same purposes as No. 1. Heads used for brushes after the seeds are removed but are not so good as those of No. 1."

The height as grown here was fully six feet, the plants being taller and later than a Japanese variety of the same species. Most of the seeds matured.

No. 4. *Panicum Crus-galli.* "Height about the same as No. 3. The heads somewhat resemble No. 1, but are not used for brushes. The plant is used for forage and the seeds are used with rice by the poorer classes and during bad seasons. Cattle do not like the seeds."

Similar in general appearance, but later in maturity than a Japanese variety of the same species obtained through the Massachusetts Agricultural College. The Corean variety did not begin to head until the last of August, by which time the Japanese variety had entirely matured its seeds.

No. 5. *Setaria Italica.* "Height about the same as the last two. Heads close, some long, some short. Used very largely for food in the north where rice does not grow well. Much raised in mountainous districts for food. Plant used for forage."

This made a vigorous growth, much like German millet, and had ripened part of its seed when killed by frost, September 23. The variety is not quite uniform in character; most of the heads are close and slender, not much over half an inch in diameter, but some are larger, more like German millet.

Siberian millet, *Panicum miliaceum.* Received in the spring of 1896 from the U. S. Department of Agriculture. Sown May 20, it was nearly all headed out June 29, before any heads had appeared on an adjoining row of American "Broom Corn Millet," sown at the same time. Both varieties ripened nearly together about the middle of August. The Siberian variety was a little more dwarf than the American, and late in the season, after the main crop had ripened, it continued to send out additional and smaller fruiting panicles, while the American variety died completely after maturing its seed.

Ankee Grass. *Panicum Crus-galli.* From the U. S. Department of Agriculture in the spring of 1896. Seed collected in southern California and Arizona, where it is used as food by the Indians.

Sown May 20 on deep, fertile, sandy soil, in the same series with the millets above described, it was the latest of them all to develop, most of the plants heading out, but none of them maturing their seed. In general habit it resembles the Corean and Japanese varieties of Crus-galli above described, but the panicle or head approaches more nearly our native form. The plants are extremely erect, often seven feet high, with sharp-pointed erect leaves. In seasons like the present all three forms would produce an immense amount of excellent fodder.

SACALINE.

Polygonum Sachalinense, Max.

While we do not consider this forage plant of any value for the people of this State, a brief report upon it may be of interest. Our plants were started by sowing the seed in the greenhouse, March 20, 1895. In May,

after the ground had become warm, fifty plants were transferred to the open ground, into good rich loamy soil, and set four feet apart each way. They were shaded for a few days and given good care through the season and made a thrifty growth, sending up half a dozen or more stems about three feet high from each root. Several of the plants produced blossoms. The next year, 1896, the growth was larger, forming a thicket three and a half to four feet high. Some of the stems measured fully eight feet in total length. A few suckers were produced from underground shoots at a distance from the main plant but such cases were not numerous. All the plants blossomed profusely this year about the last of August, some being earlier than others. About half the number produced seeds in abundance, the remainder bearing staminate flowers only and producing no seeds. A portion of the seeds became ripe enough to grow, but half or more were still too green for germination when the plants were killed by frost on September 22. A limited test was made of the feeding qualities of the plant. Young leaves and shoots were offered to cattle, sheep and horses, which ate them readily. Some of the objections to sacaline as a practical crop to grow are:

1. It is more troublesome to start than other fodder crops.
2. It will remain as a weed when the ground is wanted for something else.
3. It cannot be cured and handled as hay.
4. The stems quickly become woody and unfit for feed.
5. The yield is no greater than that of corn and other crops more easy to manage.

FLAT PEA.

Lathyrus silvestris.

Information gained regarding this plant during the year relates to its yield, seeding habit and palatability to stock. The last point suggests what now appears to be the greatest hindrance to its use. Stock which are well fed, as those of the college herd, consume the fodder in both the green and dry state in most cases so far as tested with great reluctance. While the fodder is young and succulent it has been found practicable to make use of it in the green state for one of the fodder rations of the day, but green clover or alfalfa are under the same conditions relished much better.

During the present damp season the plants of the flat pea have produced few blossoms and very little seed. The growth, however, has been heavy. On June 29 one acre was measured off, and on this and the two following days the crop was cut and weighed as fast as it could be hauled to the scales. The total product from the acre in the green state was 23,997 pounds, or practically twelve tons. The crop was at once spread out again and dried for hay, which when cured weighed 5,431 pounds, or about two and three-fourths tons. On September 16 and 17 the same acre was cut again, yielding 17,188 pounds or over eight and one-half tons when green, which shrank to 3,636 pounds or a little over one and three-fourths tons when cured. The total yield of hay from the acre for the season was therefore a little over four and one-half tons. Last year the yield from the same ground from a single cutting was only three-fourths of a ton per acre.

HAIRY VETCH.

Vicia villosa.

This plant has also been called Villous vetch, Sand vetch, Winter vetch, Russian vetch and Siberian vetch. It is a native of western Asia and has been cultivated to some extent in Europe for about fifty years, particularly in northern Germany. Other species of vetch are cultivated in certain parts of Europe more largely than this one, but within the past few years hairy vetch has received increased attention in both Europe and America. This plant is of special interest to growers in this country on account of its hardiness and its prospect of filling a place not fully occupied by any of our other leguminous crops. Then, too, while some of the other vetches have been of greater value in Europe this one appears to be the only species which thus far has shown a fair prospect of success in the United States. Among the inquiries that have come to the station regarding this plant within the past two years several are from seedsmen who have been investigating its merits with the view of offering the seed to their customers.

Under date of January 26, 1896, Peter Henderson & Co. write:—

"We are much interested in this plant, believing that it is a good deal hardier than Scarlet clover and will prove to be a valuable forage plant for fall sowing."

J. A. Everitt writes November 9, 1896: "If you have made any tests of *Vicia villosa* (Sand vetch) we would like to have bulletins containing the reports."

The Northup, Braslan, Goodwin Co. wrote in March, 1894: "We are in receipt from one of our European correspondents of a sample of Sand vetch, or '*Vicia villosa.*' He says regarding it: 'There is another plant which is coming very much forward here, and which has done well. We did not see a single notice yet in any of the American catalogues, and still we may say that it is a remarkable plant. It was grown considerably last year in Europe, and did splendidly; especially through the dryness. This vetch is called 'Sand vetch' because it will grow on the worst land, as dry as sand, but it will do as well on wet land, in fact on any land, from the poorest—excepting poor chalk; 50,000 kilos on the hectare has been obtained in three cuts; that is over 20 tons per acre. It is sown in August in winter rye, and if the time is good you may have a cut before winter. If not, let it stand, and early in the spring, in April, you may have a cut of five tons to the acre. In twenty-five days later you may have another cut, which is generally larger than the first. You may have a third cut thirty days later, and then you turn it in. It contains very much nitrogenous matter. You must sow with rye because that vetch do come so high that it cannot stand up, and the rye serves as poles. It does not freeze. We tell you there is something in that vetch, especially for countries where it does not much rain—dry lands.' You will notice that we have quoted the exact words of the Belgian who wrote us this letter. We divide with you the small package that he sent us, and should be glad to have you try it and have your opinion. Should this, in your judgment, prove valuable, we shall likely give it considerable mention in our catalogue another year."

This vetch is usually considered a winter crop, but it may be sown in either fall or spring. In this locality self-sown seeds usually germinate in the fall, and the young plants live over and produce a crop the following season. A plot sown to hairy vetch will thus maintain itself year after year. It is recommended abroad to sow the seed with oats, as is done in this country with field peas, and harvest both crops together for feed. In the spring of 1896 this Station sowed half an acre of mixed oats and vetch according to this plan. The vetches, however, made practically no growth until after the oats were harvested, although the young plants maintained their existence. After the oats were removed there was a plentiful supply of rain and the vetches came on and made a vigorous growth. Our notes on August 19 say: "Villous vetch sown in oats last spring is now thrifty and as high as the oat stubble—a few flowers are seen." Three days later the statement appears: "Vetches growing rapidly and now hide nearly all the stubble." Growth continued luxuriant through September, but was checked by the frosts of October, though the foliage was still uninjured.

On November 12 five square rods were cut and weighed, furnishing 430 pounds of green forage, or at the rate of nearly seven tons per acre.

Our experience in feeding this vetch was somewhat unsuccessful at first. During about six weeks the rams belonging to the college were pastured on rape and crimson clover in an enclosure adjoining the plot of vetch, and from time to time small quantities of the latter were cut and given to them. This was eaten quite reluctantly, although the pasture was very short. A little later two valuable rams, newly purchased, were fed in the stables on green rape and vetch. At first the rape was eaten freely and the vetch with some hesitation, and after a few days the rams refused the vetch altogether. Later in the season as cold weather came on and other green feed became scarce some of these vetches were cut and fed to cows and sheep. The cows ate them heartily; the sheep not quite so well. Possibly the frosts of autumn may have modified the flavor of the vetches somewhat, or the result may have been due to the keener appetites of the stock as colder weather came on. Vetches are highly nutritious, even more so apparently than clover. An analysis quoted in a circular on this plant issued last year by the Department of Agriculture gives their content of protein or nitrogenous matter in the dried material as 22.78 per cent. It is not at all uncommon for stock to refuse leguminous plants as food, or choose the ordinary grasses in preference, notwithstanding the higher nutritive value of the legumes. With a little care in feeding, however, it is well known that pea vines, bean straw and other fodders of this class are eaten by most kinds of stock, and prove highly desirable foods. We think, therefore, that no one need have any apprehension that this vetch cannot be made available as fodder, or that any reluctance that may be manifested by stock toward accepting it cannot be overcome. A favorable report upon hairy vetch appears in a recent bulletin of the Ohio Experimental Station in which it is stated that this plant is relished by sheep, horses and cattle.

The hairy vetch is a slender plant, the stems often trailing upon the ground, where there is sufficient room, to a distance of six to ten feet. It is recommended on this account to sow the seed with oats if sown in the spring, or with rye if sown in the fall or late summer. Our experience in seeding with oats as above recorded was not at all successful

in respect to harvesting the two crops together, since the vetches made almost no growth until the oats were cut. Further experiments in this direction are, therefore, needed for this locality.

We were able, however, to secure a portion of the crop with an ordinary mower, notwithstanding it was matted together and lay close upon the ground, and believe no serious difficulty will be found in harvesting the crop even if it be sown alone. As a plant for green manuring its spreading habit of growth will of course be no especial detriment. When sown broadcast with no other crop about one and a half bushels of seed are required per acre. The seed at present is all imported and costs about $4 a bushel.

CLOVER SEEDING.

The series of unfavorable clover seasons, ending with 1895, gave place the present year to one unusually favorable to that crop. Almost without exception the clover seed sown in the spring of 1896 made a good catch, and a vigorous summer growth, while the few fields remaining from previous seedings produced good crops. The root borer, which has done much harm for a number of years past, has apparently been less prevalent this season, owing possibly to the diminished feeding ground as a result of the recent clover failures. It is to be hoped, however, that its numbers will continue to diminish, as they appear to have done in New York and elsewhere. The abundant summer rains this season developed a vigorous second growth, which in many places was cut for hay. Even the clover sown last spring came on in many cases after the grain was harvested so as to produce a crop worth cutting for hay. On the College farm a twenty acre field seeded upon wheat last March was cut for hay the last of August, yielding one and one-half tons per acre. Owing to the succulent condition of the clover and the unfavorable weather it was slow in curing, and a portion of the crop was spoiled.

A brief experiment on the effect of a growing grain crop on a clover seeding was performed this season on a half acre of rye seeded to clover last March. Just as the rye was heading out a portion of the plot was cut and taken from the field. At the time of blossoming another portion was cut and removed, while the remainder of the plot was allowed to ripen, and produced a heavy crop of grain. Notwithstanding the favorable weather, there was a marked difference in the appearance of the clover on the three sections of the field. Where the rye was cut first the clover was vigorous and uniform and a perfect stand; where the second cutting was made the clover was smaller and there were a few vacancies where weeds made their appearance; and where the rye was allowed to ripen the clover was thin and there were large spots where it was completely killed out and which came up to ragweed and other foul growth.

Two years ago the experiment was performed of seeding a plot to clover every month in the year. The results were so instructive that this year the experiment is being repeated on a different soil and under what are proving to be different conditions as to moisture. In the preceding trial a large portion of the seed sown in the early summer failed to germinate, but so far this season a full stand has been obtained from every

seeding. A full report, including the effect of the winter on the young plants from the seed sown late in the season, must be deferred until next year.

MAMMOTH CLOVER SEED.

In April, 1895, fifteen samples of mammoth clover seed, obtained from various sources, were sown in adjoining rows, each row being eight rods long. By the side of these were sown for comparison four rows of medium clover with seed from different sources. All the seeds grew well, and important differences were noted the first year in the growth of the different rows. The second year, as the plants began to blossom, the difference became more clearly marked. From the following table and the accompanying notes it will be seen that several of the varieties were not true to name and that nearly all the samples were more or less mixed. Also that there were distinct variations in each variety, some samples being earlier, more vigorous, or otherwise different from others of the same kind. Two of the samples were practically pure, No. 12, an early, vigorous and rather dwarf strain of medium clover (purchased, however, for mammoth), and No. 16, an equally pure and distinct sample of mammoth clover, somewhat later than the rest. From the column marked "seeds per gram" it does not seem that the weight or size of the seed is a reliable test between the two varieties. In this case the grains of medium clover generally, but not always, weighed less than those of the mammoth clover.

Row.	Seeds per gram.	Variety.	Source.	July 30 and 31, 1895 *	May 26, 1896.
1	761	Med	A. J. Brown Co., Grand Rapids, Mich. (Kent county seed)	About half the plants in blossom	These first four rows are much alike, all being early, about 18 inches high and containing many blossoms. No. 4, however, is the earliest, containing the most blossoms, and No. 2 the latest. The plants now in flower appear to be all medium clover. There are more or less flowers visible in every row.
2	770	"	L. J. Haddrill & Co., Lapeer, Mich.	About one-third as many blossoms as in No. 1	
3	683	"	Henry Phillipps Seed Co., Toledo, Ohio	About one-seventh as many blossoms as in No. 1	
4	700	"	J. C. Vaughan, Chicago, Ills.	Blossoms about equal to No. 2	
5	666	Mam.	A. H. Whitehead, Lansing, Mich. (Clinton county seed)	Plants small, blossoms few and scattered, about like No. 3	These three rows are much later, not so tall and more leafy; few blossoms.
6	610	"	Livingston's Seed Store, Des Moines, Iowa	Plants small, almost no blossoms	
7	660	"	S. Brown, Kilbourn City, Wis.	Like No. 6, but perhaps a few more blossoms	
8	621	"	Lewis & Chambers, Louisville, Ky.	Plants larger than in No. 7; a few scattered blossoms	A little earlier and taller than the preceding three rows; few blossoms.
9	624	"	Albert Dickinson Seed Co., Chicago, Ills. (Bloom brand)	Similar to No. 8	
10	652	"	Albert Dickinson Seed Co., Chicago, Ills. (Bangle brand)	Plants larger and more thrifty than in the last five rows	
11	675	"	J. A. Foote, Terre Haute, Ind.		
12	632	"	J. C. Vaughan, Chicago, Ills.	Large thrifty plants and nearly as many blossoms as in No. 1	The earliest in the entire series—in full flower.
13	732	"	A. J. Brown Co., Grand Rapids, Mich. (Kent county seed)	Plants mostly large and thrifty with a few scattering blossoms	Fine and vigorous, not so tall now as No. 12; about 17 inches high.
14	668	"	Smith & Corning, Kilbourn City, Wis.	About like No. 13	
15	647	"	S. W. Flower & Co., Toledo, Ohio	About like No. 13	Similar to rows 1 to 14.
16	632	"	Johnson & Son, Goshen, Ind.	About like No. 13	The latest in the series, only one flower-head visible; 16 inches high. Very thrifty.
17	668	"	Henry Phillipps Seed Co., Toledo, Ohio	About like No. 13	The tallest rows in the series, 18 to 21 inches. Row 18, the tallest and earliest of the three, contains numerous blossoms. All are somewhat later than rows 1 to 4.
18	612	"	F. T. Caughey & Co. Detroit, Mich.	Large thrifty plants and one-third as many blossoms as in No. 1	
19	652	"	A. J. Brown Co., Grand Rapids, Mich.	Few blossoms	

* The notes in this column were taken by Mr. C. D. Butterfield, who also sowed the seed and cared for the plants the first year.

May 29.—Rows 1, 2, 3, 4, 12, 15 and 18 in full flower and distinctly earlier than any of the others.

June 29.—The entire series appears at a little distance like a uniform field of mammoth clover. This variety now averages twenty-seven inches high, being four to six inches taller than the June or medium clover in the same or adjoining rows. The only rows in which medium clover is now readily visible are Nos. 1, 4, 12 and 18. The heads of the medium clover are now nearly all dead ripe; those of the mammoth clover have about half of the flowers faded. The blossom-heads and upper leaves of the mammoth clover are much smaller than in the red clover.

COMPARATIVE YIELD FROM PASTURE AND MEADOW.

In 1894 two plots of orchard grass, as near alike as possible, were laid off side by side, each plot being two rods wide and four rods long. One plot was allowed to grow in the ordinary way and was cut for hay. The other plot was cut frequently with a lawn mower in imitation of pasture, the product being carefully saved and weighed. Below are the dates of the several cuttings, with the yields of dried hay from each:—

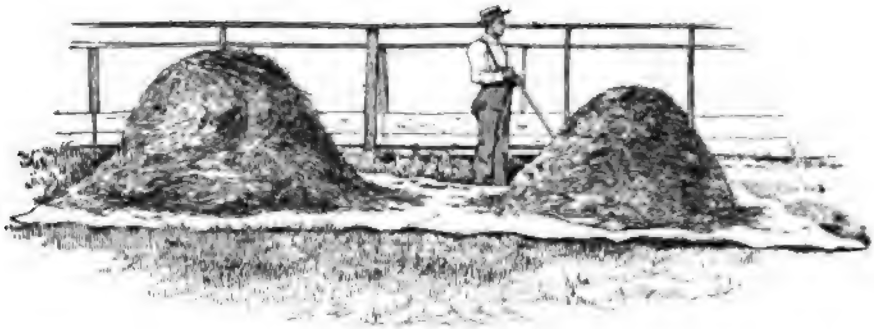
April 26	5 pounds, 8 ounces.
April 31	1 " 4 "
May 8	5 " 4 "
May 11	1 " 8 "
May 27	8 " 8 "
June 4	4 " 4 "
June 8	2 " 12 "
Total	29 pounds.

On June 8, the last day of the above cutting, the plot reserved for meadow was cut and yielded just 100 pounds of cured hay.

In the following year an attempt was made to repeat the experiment but the extreme drouth prevented. In 1896 the experiment was repeated in two localities. One of these was on the same plots used in 1894, except that this year the plots were reversed, the plot formerly cut in imitation of pasture being left for meadow and *vice versa*. This season only four cuttings were made, the yields of which, both green and dry, were as follows:

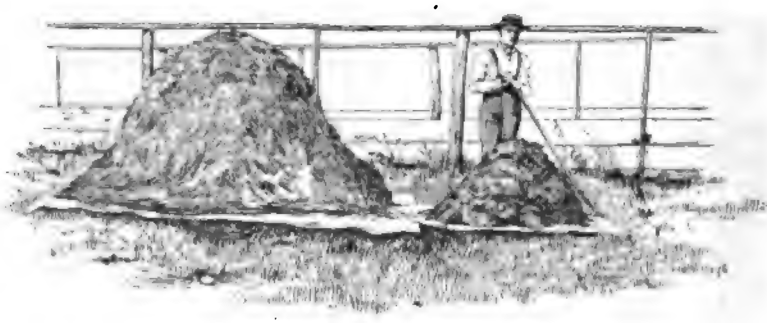
Date.	Green. Pounds.	Dry. Pounds.
May 4	117	37.5
May 12	39.75	13.25
May 21	16	6.875
May 28	9	6.125
Totals	181.75	60.9

On May 26 the plot reserved for meadow was cut, yielding 300 pounds of green hay which made 112.5 pounds when cured.



In another field the same experiment was performed with timothy, the plots in this case being each one by six rods in size. The "pasture" plot in this case was cut eight times and yielded as follows:—

Date.	Green. Pounds.	Dry. Pounds.
April 30	17	8.88
May 6	16.25	
May 13	6	2
May 23	7.5	2.25
June 1	5	2.63
June 8	.625	.31
June 19	2	.56
June 24	1	.53
Totals	55.875	15.76



On June 24 the corresponding plot left for meadow was cut for hay, the product being 415 pounds when green and 172 pounds when cured for hay.

Combining the results of the above three trials we have, from the frequent clippings in imitation of pasture, 95 pounds of hay, and from the same area at a single cutting 384 pounds, or a yield four times as great. Short grass is known to be more nutritious than fodder which is more mature. To determine how much this fact might offset the greater gain in weight from the single cuttings a sample of hay from the single cutting

and one from the combined clippings of the timothy in the above experiment were analyzed by the Chemical Department with the following results:—

Sample of timothy hay from single cutting.

Water, 17.69 per cent.	
Water free substance:	Per cent.
Ash	7.00
Ether extract	1.90
Crude protein	7.81
Crude fiber	40.21
Carbo-hydrates	43.08
Total	100.00

	Per cent.
Total nitrogen	1.25
Albuminoid	1.05
Amide	.20

Sample of dried timothy from eight cuttings.

Water, 63.95 per cent.	
Water free substance:	Per cent.
Ash	9.61
Ether extract	4.61
Crude protein	22.62
Crude fiber	22.01
Carbo-hydrates	41.15
Total	100.00

	Per cent.
Total nitrogen	3.62
Albuminoid	1.45
Amide	2.17

The percentage of nitrogen, represented as crude protein, is here about three times as great in the clippings as in the ordinary hay, a larger portion of it however being in the amide state which is of comparatively low feeding value. Of the other food constituents the ether extracts or oils are much more abundant in the young grass, while the carbohydrates, or starches and sugars, are in somewhat greater amount in the more mature fodder. The problem of the comparative economy of pasture and meadow contains many factors. Even the food value of a given product depends largely on the circumstances under which it is fed and the class of animals employed. On the whole there can be little doubt that the younger grass obtained from the frequent clippings is the more nutritious and valuable, but apparently not sufficiently so to overcome its smaller yield. It will be noticed that the moisture present in the dried grass from the eight clippings at the time of the analysis was much greater than in the sample of hay from a single cutting. This excess of moisture probably gathered in large part after the sample was taken. The illustrations show the relative bulk of the product in each case at the time the crop was weighed.

II. WHEAT.

EXPERIMENTS WITH FOREIGN WHEATS.

In the fall of 1895 three collections of foreign wheats were sown by the Station. First, ten cross-bred wheats from Australia. Second, ten Russian varieties obtained through the U. S. Department of Agriculture. Third, six varieties, three German and three Russian, from Haage & Schmidt, Erfurt, Germany.

I. AUSTRALIAN WHEATS.

These wheats were sent by the originator, William Farrar, New South Wales, Australia, to Dr. R. C. Kedzie, who has carefully watched their growth and made selections for further trial. The wheats as received were of the first generation from the cross and were all white in color and differed from one another very little in general appearance. The originator states that they were chosen mainly for their probable milling excellence. Their parentage was as follows, the original stock or female parent being written first and the male or pollen parent second. It will be noted that the parent varieties themselves are in some cases crosses:

1. Improved Fife x Crépi.
2. Improved Fife x Rye Wheat (Blé Seigle).
3. Improved Fife x Marshall's No. 8.
4. Improved Fife x (Gypsum x Crépi).
5. Improved Fife x (Blount's Fife x Ward's Prolific).
6. Improved Fife x Ward's Prolific.
7. Improved Fife x White Lammas.
8. Improved Fife x (Improved Fife x French Early White).
9. (Improved Fife x Gypsum) x (Hornblende x Indian B).
10. Fultz x Crepi.

Following are brief descriptions of the varieties entering into the above crosses:

Improved Fife. A spring variety, originated apparently by Professor A. E. Blount, of New Mexico. Described by C. C. Georgeson of the Kansas Experiment Station, as follows: Plants erect, irregular in height, straw medium to slender; heads poorly developed, bald, of medium length, slender, moderately compact, round to square, and tapering; chaff white; grain red, of medium size.

Crepi. Of French origin. Described by Vilmorin as the hardiest of the winter wheats. Straw tall and flexible; head bald and slender; chaff white; grain soft, of medium size, dull grayish red, threshing easily.

Rye Wheat. A variety which in France is sown in either fall or spring and is there grown on rather poor lands, such as are customarily sown to rye. Straw rather tall, erect and flexible; heads bald, loose, tapering; chaff bronze, covered with fine silvery hairs; grain reddish or pale amber.

Marshall's No. 8. Grain large and long, translucent, yellow, hard to thresh and of medium density.

Gypsum (Blount's No. 38). Straw rather coarse and weak; head bald, medium long, compact, erect; chaff white; grain white, short, plump (Oregon).

Ward's Prolific. Grain rather small, hard, translucent, threshing hard. Plant resistant to rust.

White Lammas. Apparently an old English variety with long, loose, beardless heads.

French Early White. Character unknown.

Hornblende (Blount's No. 37). Straw fine, soft and weak; heads small, loose and pointed; grain small, short, white and flinty, threshing easily.

Indian B. Grain of medium size, white and soft.

Fultz. Of Pennsylvania origin. Straw small but stiff; head bald; chaff white; berry red, rather small, plump and hard.

Only about 100 seeds of each of the ten cross-bred varieties were received. These were sown September 10 on rather heavy loamy soil, in rows sixteen inches apart, one seed to every six inches in the row. The weather was dry and the plants made a rather small autumn growth and all the kinds were badly injured by the following winter, although protected by a light covering of corn stalks. Some of the varieties were injured more than others, the following being their arrangement in the order of hardiness, judging by the bulk of straw produced by each kind the next season: 8, 5, 7, 2, 1, 4, 6, 10, 3, 9. The last four were very severely injured, No. 9 being entirely killed out. The general appearance of the varieties while growing was much alike. All the heads were beardless, of good length, but not very compact, and with the chaff more or less tinged with brown. Some minor distinctions could be noted but they were not sufficient to justify full and independent descriptions until the varieties have been longer cultivated and larger quantities secured. There was moreover in some cases a variation in the appearance of the heads belonging to a single sample or variety. The grain from all the samples was more or less shrunken, and darker in color than the seeds sown. There were greater differences apparent in the grain from the different numbers than was noted in the straw and heads, quite sufficient in some cases to indicate distinct varieties. There was considerable variation in the shape of the kernels, and in some cases sufficient differences in color so that some of the varieties would be classed as white wheat and others as red. The kinds selected for further trial, and which were sown in the fall of 1896, were numbers 1, 2, 4, 7, 8.

No. 1. Kernels short and red, considerably shrunken.

No. 2. Kernels red, of average shape and size, mostly well filled.

No. 4 Kernels dark red, of average shape and size, badly shrunken.

No. 7. Kernels rather small, short and plump, light to dark red. A second type, with much larger kernels was also planted.

No. 8. Kernels white or nearly so, of about average size and shape, only slightly shrunken. A second type, having red kernels, was planted also.

2. RUSSIAN WHEATS.

Seeds of the following ten varieties which had been imported from Russia were received late in the autumn of 1895 by Dr. R. C. Kedzie from Mr.

M. A. Carleton, of the U. S. Department of Agriculture. They were sown on rather light sandy soil and, the weather being dry, they failed to come up until just before winter set in. Some of the kinds passed the winter well, but others were badly winter-killed. In hardiness the varieties stood in the following order, judging by the number of plants that remained at harvest time: 3, 4, 2, 7, 8, 6, 5, 1, 9, 10. The first three of these were but little injured, the next two were about half killed, and of the remaining varieties there survived of each only a few scattering plants. The varieties were as follows:

1. *De Tiesse.* Winter-killed.
2. *Krimsh.* From Karkov. Straw rather short; heads bearded, of fair length and well filled; chaff mostly white; grain of about average size and shape, hard, dull red; hardy.
3. *Gray Winter.* From Gradno. Straw long, abundant, erect; heads bearded, large and long, many reaching six inches and over in length without the beards; chaff light brown; grain red, rather soft; hardy.
4. *Red Bearded.* From Karkov. Straw coarse; heads bearded, rather slender; grain hard, deep red, somewhat shrunken. Heads well filled, numbering as high as 80 grains. Hardy.
5. *Chernokoloska.* Winter-killed.
6. *Arnautka.* Winter-killed. This is a bearded, red, hard, spring wheat. It was formerly introduced from Russia about thirty years ago and gave promise of being a valuable variety, but for some unknown reason has been but little grown.
7. *Barnatka.* From Poltava. Badly winter-killed. Straw rather short and coarse; heads bearded, of medium length; grain red.
8. *Kajavka.* Badly winter-killed. Straw coarse; heads bald, of good length; grain red, badly shrunken.
9. *Kubanka.* Winter-killed. See description below among the wheats from Germany.
10. *Belotourka.* Winter-killed. This appears to be a spring variety. It was gown and described by the N. Y. (Geneva) Station in 1888.

3. WHEATS FROM GERMANY.

The following varieties, from Haage and Schmidt, Erfurt, Germany, were received and sown in the fall of 1895. All were purchased for fall wheats, numbers 1, 2 and 6 being Russian, the others German varieties. All were sown Sept. 16 on tenth acre plots, except the last, which was sown on the 14th on about one-eighth of an acre. The soil was rather heavy loam. Following are the yields:

Varieties.	Pounds of grain and straw.	Pounds of grain.
1. Russian	270	91.5
2. Sandomir	154.5	31
3. Waldersdorf	90	12 25
4. Seelander	79	21 5
5. Schilf (large plot)	63	6 25
6. Kubanka	53	15.5

The first column in the above table shows very well by the variation in the total yield the comparative injury to each variety by winter-killing,

while the variation in the ratio of grain to total product, shown by comparing the weights in the two columns, gives a general indication as to which varieties were best filled. A more detailed account of each variety appears below.

Russian. The earliest and dwarfest variety on trial. Perfectly hardy. Straw small and slender, yellowish when approaching maturity, not inclined to lodge; heads bearded, very light brown, slightly curved, small and tapering, but well filled, the grain separating easily from the chaff; grain very hard, red, plump and of fine appearance. A promising variety.

Sandomir. Straw tall and erect, heads bald, slender but fairly compact, somewhat curved; chaff brown; grain amber. Grain not so plump, and paler in color than the original seed. Season medium to late.

Waldersdorf (Count Waldersdorf Improved, *Graf Waldersdorfscher regenerirter*). Straw tall and erect; heads bald, square, of medium length and size, somewhat curved, nearly white, closely resembling Dawson's Golden Chaff. Grain red, hard, shrunken. Original seed exceedingly plump.

Seelander. Very late, with large, tall, erect straw and long, bald, rather slender heads, often tinged with dark brown; grain of average size and shape, light red, badly shrunken.

Schilf (*Schilfweizen*). [Reed-Wheat.] Straw large, stout and erect; heads bald, erect, very short and thick, somewhat club-shaped or thicker toward the top, the spikelets packed tightly together in the head. It ripened, or dried up, early, being apparently injured by the heat. Grain shrunken so as to be almost worthless. The seed sown was very plump, almost spherical, rather soft, and of a beautiful yellowish color. It is classed with the white wheats. In Germany this variety is said to be adapted to soils of only moderate fertility. It is evidently an excellent sort, but requiring a different climate from ours.

Kubanka. A very striking and distinct variety, of fine appearance, with large, heavy, nodding, compact heads, covered, as are the stems, with a thick, bluish bloom, the heads remaining of a bluish gray when ripe; awns reddish, very large, spreading outward at maturity; grain of a beautiful pale amber color, large, long and flinty. Much of this season's crop was shrunken. This is recorded in foreign catalogues as a spring variety and has been tested as such by several experiment stations in this country. It was sent to us, however, both by way of Washington and direct from Germany, as a winter variety. It is certainly too tender for a winter variety here.

TEN MICHIGAN WHEATS.

In August last a circular was sent to about two hundred representative farmers in the State asking what varieties of wheat were grown in their several localities and which were grown most extensively. Replies were received from one hundred and thirty of these correspondents in fifty-four counties. Below are the names of the wheats reported, with the number of times each variety was mentioned. The figures in parenthesis indicate the number of localities from which that variety was reported as the leading wheat:

Red Clauson (43) 92.
White Clauson (39) 92.
Jones' Winter Fife (5) 34.
Diehl-Mediterranean* (6) 26.
Egyptian (4) 18.
Fultz (3) 25.
Nigger (2) 35.
Mediterranean (2) 10.
Poole (1) 25.
Rudy (1) 15.
Dawson's Golden Chaff (1) 9.
Democrat (1) 8.
Red Russian (Spring) (1) 4.
Martin's Amber (1) 3.
Minnesota Hard [Fife] (Spring) (1).
European Mediterranean (1).
Diamond Diehl (1).
Cumberland Valley (1).
Michigan Fultz (1).
Lancaster 7.
"Hybrid" 4.
"Amber" 4.
Michigan Amber 3.
American Bronze 3.
Number Six 3.
Empire 3.
Hybrid Diehl** 3.
Diehl 2.
Jones' Square Head 2.
Ruby 2.
Velvet Chaff 2.
World's Fair 2.
Fife 2.
Golden Amber 2.
Lincoln 2.
Valley 2.
Egyptian Amber 2.
Bald Eagle 1.
Beal 1.
California 1.
Canada Swamp 1.
Chesua 1.
Connecticut White 1.
Danforth Red 1.
Diehl Lancaster 1.
Early Genesee Giant 1.
Finley 1.
Fulcaster 1.
Gold Drop 1.
Gold Dust 1.
Gold Medal 1.
Golden Cross 1.
Golden Grain 1.
Greening 1.
Mammoth Bald 1.
Number Nine 1.
Perfection 1.
Red Chaff Amber 1.
Red Chaff Clauson 1.
Red Cross 1.
Rice 1.
Root [probably Rudy] 1.
Scotch Fife (Spring) 1.
Scotch Valley 1.
Scott 1.
Silver Chaff 1.
Smith 1.
Surprise 1.
Swamp 1.
Tennessee Amber 1.
Traverse 1.
Travis 1.
White Amber 1.
Wisconsin Amber 1.
World's Wonder 1.

Of the seventy-five varieties in the above list twenty are reported as the leading sort in one or more localities, but not to exceed ten, judging from the number of times each is reported, can be considered as popular, or extensively cultivated in the State; of these ten, Red and White Clauson stand far in the lead, followed by Nigger, Jones' Winter Fife, Fultz, Poole, Rudy, Diehl-Mediterranean and Egyptian. Special mention may also be made of Number Six, Dawson's Golden Chaff and Buda Pest, new varieties now growing in popularity. Of the whole number, thirty-six, or about one-half, are reported only once.

Three varieties of spring wheat are reported in the above list. There is no extended spring wheat territory in Michigan, spring wheats being

* Including Hybrid Mediterranean and Michigan Bronze.
** Probably Diehl-Mediterranean.

grown in only limited sections north of Saginaw bay where the winter varieties do not succeed. Comparatively little wheat is grown in the northern part of the State, and of the amount there grown probably over one-half is winter wheat, grown in localities protected by the lakes or by large bodies of timber. The following ten varieties are selected for further description:

WHITE CLAUSON.

Description. Plant very hardy, vigorous, stooling freely, foliage abundant, straw only moderately strong, inclined to lodge on low or rich land; heads bald or nearly so, a few short beards often appearing on the upper part of the head; the heads long, moderately compact, curving downward when ripe; chaff usually becoming more or less brown as the grain matures; chaff moderately open, protecting the wheat in wet weather less effectually than some other kinds and also rendering it somewhat inclined to shell when overripe; kernel of good size, not very hard, white, becoming light amber in some localities.

The history of this wheat is as follows: In the year 1865, Mr. Garrett Clauson, and his son, Wilmer S. Clauson, of the township of Lodi, Seneca county, N. Y. (P. O. North Hector, Schuyler county), were crossing a stubble field of Fultz wheat on the farm of their adjoining neighbor, Mr. Isaac Clauson. They picked up and examined various heads of wheat and each selected a head which for its length and the quality of its grain he considered superior. The product of these two heads was planted together with a hoe in a place by itself. The following season it appeared that there were two varieties present, one white, the other red. The white variety seemed the most promising and was different from any other variety they had seen. The two kinds were carefully separated and the seed rubbed out by hand, the product of the white variety being one pint. This was sown for seed and at the next harvest yielded 39 pounds. This also was sown and produced the following year eleven dozen sheaves, yielding 13 bushels. Again the product was sown and the next year there were 130 dozen sheaves, yielding 150 bushels. The following year (1870) 254 bushels were produced and some of the wheat then appears for the first time to have passed into the hands of others. In that year four bushels were obtained by Mr. Garret B. Clauson of the same township and sown on barley stubble which had the preceding year been in corn. The four bushels were sown on one acre and 130 rods of ground, which at harvest time yielded 92½ measured bushels of 62 pounds each. This wheat took the first premium at the Seneca county fair in 1871. It is perhaps from this circumstance that Mr. Garret B. Clauson instead of Mr. Garrett Clauson has sometimes been reported to be the originator of the Clauson wheat. In 1872 this variety took the first premium at the winter meeting of the Seneca County Agricultural Society; also at the Western New York Fair at Rochester the following year. About this time a farmer and general dealer by the name of Wm. Eastman, a neighbor of Garret B. Clauson, began to advertise and sell this wheat, and it was largely through Mr. Eastman's efforts that the variety became widely distributed.

Just when or by whom this wheat was introduced to Michigan is unknown; the U. S. Department of Agriculture sent out the variety in

1874; as early as 1875 it was grown by David Woodman of Paw Paw, and two years later it had become the most popular variety in the State and was in great demand by farmers for seed. In that year, however, a serious check was given to the culture of this variety by an unfavorable attitude assumed toward it by certain millers and dealers in wheat. This hostility seems to have made its first appearance in a resolution passed by the Michigan State Millers' Association at its session in Detroit in August of that year, in which the Clauson was placed at the foot of the list of five varieties recommended for cultivation. The ground of opposition was that it was considered an inferior variety "for the manufacture of flour," being particularly deficient in gluten. This action by the Michigan millers was followed by similar action in other states, with the result that the Clauson wheat became very generally discriminated against in the market and many farmers who had expected to sow this variety sowed other kinds instead. At this juncture a number of farmers of this State applied to the authorities at the Agricultural College to decide whether the objections raised to this variety by the millers and grain dealers were valid. To determine this question, the Chemist of the College, Dr. R. C. Kedzie, conducted by direction of the Board of Agriculture an exhaustive series of experiments upon the value of the flour made from different varieties of wheat and announced as his conclusion that Clauson flour "holds a good rank," and that "neither in the chemical composition nor in the physical properties of the flour of this variety of wheat does there exist any good ground for the demand to strike it from the list of wheats to be cultivated in this State." Largely as a result of this announcement, which was widely published in the succeeding fall and winter, the opposition to the Clauson wheat gradually abated, and for many years thereafter it was grown throughout this and adjoining states much more than any other variety. It is still one of our most popular wheats, though for the past few years a number of other kinds have also come to be largely grown. One complaint now made against the Clauson is that it has been so long cultivated and become so mixed with other varieties in threshing that it is difficult to get pure seed. One of the purest sources of supply of this variety of which we are informed is in the township of Gaines, Kent county. In the summer of 1895 Mr. C. G. A. Voigt, a miller of Grand Rapids, sent to the station a sample of wheat taken from a load purchased from a farmer of the above township. This wheat weighed 61 pounds to the bushel and was reported to have yielded that season 42 bushels to the acre. The wheat was so fine and heavy and the reported yield so large that Mr. Voigt thought it must be a new variety. The report from the station failed to confirm this opinion, however, and a few weeks later a representative of the station visited the farm on which the wheat was grown and became satisfied from the history of the wheat and from specimens collected that the variety was White Clauson. To distinguish this strain of wheat however the name Corinth Clauson, suggested by Dr. R. C. Kedzie, has sometimes been applied to it, the name being given from the fact that the wheat was grown near the village of Corinth. A small quantity of this wheat was obtained and sown on the college farm in the fall of 1895 where it proved to be a very pure strain of White Clauson wheat. The following year the above locality was again visited and arrangements

were made with a farmer who had grown this variety exclusively for about 25 years to supply this wheat for seed purposes.

RED CLAUSON.

Season medium to early, hardiness and vigor medium; straw coarse and upright, of medium height and strength; head bald, square and compact, often club-shaped or thicker toward the top, curving moderately downward when ripe; chaff very dark, easily separating from the grain; grain large, dull red, rather soft.

This is now probably the leading variety grown in the State, being exceeded, if at all, in area only by the old White Clauson. Its superiority over White Clauson in many cases appears to be due mainly to its shorter, stiffer straw, making it less liable to lodge, and to its somewhat earlier maturity. Reports as to its yield are nearly always favorable and it appears to be especially able to give good returns in dry seasons. The berry is large and fine but there have been some complaints from millers on account of its softness. In hardiness and vigor this variety is not quite equal to the White Clauson.

The Red Clauson originated in 1881 on the grounds of A. N. Jones, Leroy (now at Newark), N. Y., and is said to have been produced by artificially fertilizing the White Clauson with pollen of the Golden Cross. It was not generally introduced until 1888. The Red Clauson possesses many of the characteristics of the White Clauson but is unquestionably a distinct variety.

DAWSON'S GOLDEN CHAFF.

Plant very hardy, straw stiff, heads bald, close and uniform, bending moderately downward in ripening, chaff adhering rather closely to the grain, kernel plump, white, of medium size.

This variety originated in 1885, one stool, containing five stalks, being found at harvest time in that year on a bare exposed hill in a field of White Clauson, where the surrounding wheat had been winterkilled. The farm on which it originated is located about two miles west of Galt, Ontario, and was owned at the time by Mr. Robt. Dawson, who discovered, propagated, and introduced this variety which bears his name. The present address of Mr. Dawson is Paris, Ontario.

The Golden Chaff appears to have been first introduced into Michigan by Mr. John Sturgis, of Sturgis, St. Joseph county, who purchased of Mr. Dawson four bushels in the fall of 1893. Its general introduction however resulted from the purchase and distribution of ninety bushels by the State experiment station the following season. The station was led to introduce this variety for trial chiefly because of its success in the province of Ontario where the climate is similar to that of the southern peninsula of Michigan. For two years it had stood at the head of the varieties tested in the coöperative experiments conducted by the Ontario Agricultural College, located at Guelph, and for three years it had stood first among the 53 varieties of wheat grown for trial on the experimental grounds connected with that college. Over a large part of Ontario it had become the leading market variety, being in especial demand to mix in

grinding with spring wheat from the northwest, and sometimes bringing an advance over the market price for that purpose.

The results of the first year's distribution by the Michigan experiment station were so satisfactory that in nearly all cases so far as known the wheat grown was used for seed. About 400 bushels grown on the college farm were distributed by the station in the fall of 1896, the amount produced being insufficient to supply the demand.

The special merits of this variety, aside from the color and quality of the grain, are its hardiness and stiffness of straw, adapting it to cultivation on low, black land where many varieties winterkill and where the White Clauson is inclined to lodge and fail to properly fill. On such land, which occurs in large quantities on the margins of reclaimed swamps in this State, the Dawson's Golden Chaff has produced most excellent crops of wheat, though of a somewhat darker color and not always as well filled as when grown on upland.

In 1895 eight well known varieties of wheat were grown in quarter acre plots on pure muck land upon the college farm. The results are published on another page and show the Golden Chaff and White Clauson to have given much better results than any of the others, the figures as between these two varieties being somewhat in favor of the Golden Chaff. The following year the same experiment was repeated with ten varieties and again Golden Chaff and White Clauson stood the best, giving practically equal yields. Of course, it is understood that pure muck is unsuitable for the growing of wheat, and this test was therefore exceptionally severe, but the results of these two seasons' trial on muck tend strongly it is believed to illustrate the hardiness of these two varieties and their superiority over some of our other varieties for low land. This fact, in the case of the Golden Chaff, is the more worthy of note because it may develop upon further trial that upon some of our dryer and less fertile uplands there are other kinds that will prove more profitable. At least it is found in certain portions of Canada where this variety has become well known, that the opinion prevails among some farmers that the "Dawson," as it is there called, requires "good land," and that on farms that have been run for a series of years there are other varieties that give a larger yield. The writer visited, in the dry season of 1895, during the threshing period, the neighborhood of the old Dawson farm in Canada where this variety originated and was there informed that it was not yielding as well as some other kinds in that locality that season. The soil of this region is hilly, often gravelly, and apparently more than ordinarily subject to drouth. In other portions of the province the reports heard were nearly always very favorable to this variety.

BUDA PESTH.

Plant of moderate vigor and hardiness, ripening early; straw rather short and slender; heads rather small, bearded, well filled, threshing easily; grain hard, dark dull red, of good length and size.

This variety was introduced into this country from Buda Pesth, Hungary, by Mr. C. G. A. Voigt, a miller of Grand Rapids, Mich. Mr. Voigt had been to Europe for the purpose of learning why the millers of Vienna and Buda Pesth were able to secure a higher price for their flour in the London market than could be obtained for American flour. He became

convinced that the fact was due, not to any difference in the milling process but to the superior quality of the Austrian and Hungarian wheats. He therefore imported one of the best varieties grown in that region and distributed the seed to various farmers in the vicinity of Grand Rapids. His first importation, made in 1892, was a failure, the seed becoming lost in transit after reaching this country. Another and successful importation was made the following year, and from this stock has descended all the wheat of this variety since grown in this country. The supply of this wheat is still small, the variety being grown as yet by but few parties outside of Kent county. Reports from that locality regarding this variety have, so far as known, all been favorable. The variety was chosen by Mr. Voigt particularly on account of its superior milling quality, a character which it seems to retain. The grain is nearly always plump and heavy, one sample grown in 1896 weighing 62 pounds per bushel. Two acres of this wheat harvested upon the college farm in 1896 averaged only 12 bushels per acre. A portion of this field however was injured by the winter and the crop was also badly infested by the Hessian fly. During the preceding autumn this field looked exceptionally well.

FULTZ.

Plant hardy, somewhat lacking in vigor; straw rather short and slender, of medium length; head bald, white, nearly square, of medium length, slender and tapering, bending downward moderately when ripe; chaff adherent rather closely to the grain; grain bright red, plump, hard and heavy.

Few varieties have had greater popularity than this throughout the central states. The Fultz originated in Mifflin county, Pennsylvania. In the harvest of 1862 Abraham Fultz of that county, while assisting one of his neighbors, found in a field of Lancaster three heads of a bald variety growing apparently from the same root. He sowed the seed from these heads the same fall and continued to propagate it, furnishing seed to others in the neighborhood, where it soon became popular. In the fall of 1871 the U. S. Department of Agriculture purchased and distributed 200 bushels of the seed. Two valuable features of this variety are its earliness and the closeness with which the chaff adhers to the grain. The latter feature makes it an excellent variety to stand wet weather and enables it to remain with safety for some time after maturity before being cut. Owing to its rather weak growth the Fultz is less adapted than some other varieties to thin soils.

JONES' WINTER FIFE.

Hardy and vigorous; straw stiff, of medium length; head bald, white, velvety, long, and curved downward when ripe; chaff adhering closely to the grain; grain amber.

This variety, originated by A. N. Jones, Newark, N. Y., is said to be a combined cross between Mediterranean, Fultz and Velvet Chaff. It has proved to be hardy and productive, adapted to a wide range of territory, from the eastern states to Iowa. It is now one of the most popular varieties in this State.

POOLE.

Fairly hardy and vigorous; straw rather short but strong; head bald, dark brown, of medium size, chaff easily separating from the grain; grain red, of good size, long and plump.

Popular in Ohio and southern Michigan. This variety has a good record at the college and in 1896 was the most productive variety grown.

RUDY.

Straw strong, of medium length; head bearded, slightly curved when ripe; chaff white, separating easily from the grain in threshing; grain light red, very large, long and plump; season medium.

This variety was introduced into general cultivation from western Ohio in 1891, but its exact origin is unknown. It appears to be increasing in popularity in Michigan. In 1894 it stood at the head in productiveness at this station.

NIGGER.

Straw strong and of good length; head long and rather loose, curving downward when ripe; bearded, the beards large and spreading; chaff white, separating easily from the grain; grain long, red; season rather early.

This variety was originated in northern Ohio about ten years ago by a colored gentleman named Sampson. It is now largely grown in many parts of southern Michigan, where it is well liked except for its awns and its tendency to shell too easily when ripe. It is regarded as an excellent variety for low land and is a good milling wheat.

DIEHL-MEDITERRANEAN.

Also known as *Hybrid Mediterranean* and *Michigan Bronze*. Plant hardy, foliage abundant, straw stiff and of good length, yellowish white at maturity; heads bearded, rather short and compact, chaff brown, holding the grain well; grain dark amber, of good size; season medium to late.

This variety has given very general satisfaction in Michigan and neighboring states. It seems to have originated about 1880 and is said to be a cross between Diehl and Red Mediterranean.

WHEAT ON MUCK LAND.

The numerous swamps of Michigan are fast being reclaimed and brought under cultivation. Wheat is not a crop usually adapted to low land, barley and some of the other grains, especially corn, doing much better. Nevertheless, the cultivation of wheat on such land is often attempted, especially for the purpose of seeding to grass, for which such

soils are well adapted. It not infrequently happens, however, particularly in dry seasons following mild winters, that wheat sown on the borders of swamps and other low places gives a better yield than that sown on the higher and more typical wheat lands. As the swamps constantly tend to disappear by the wasting away of the muck under cultivation more and more land of this kind is being devoted to grain crops. Deep muck is particularly unsuited to wheat and only the very hardiest varieties will grow upon it. The choice of varieties for the various kinds of low lands is a matter of considerable importance, and at all times certain varieties have been held in repute for lands of this character. In England forty years ago Klippart informs us that Fenton and Piper's Thickset were favorite kinds for "soft, growthy land." The Mediterranean and Wild Goose were formerly chosen for such lands in this country, but are no longer in general cultivation. A test of twelve varieties on black prairie soil at the Ohio experiment station a few years ago showed Penquite's Velvet Chaff to give the best results. For the past two years our Michigan station has tested a number of varieties on muck soil and a brief account of the results obtained in 1895 appeared in the report of the station for that year. The figures are repeated below however for comparison with the results the present season.

In the fall of 1894 eight varieties of wheat were sown in quarter acre plots upon muck, the varieties being such as were grown in larger areas elsewhere upon the college farm. They were sown with the drill during the third week in September, at the same time and in the same manner as the other wheat. The next year ten varieties were sown broadcast September 9 on similar soil, the area being three-fourths of an acre divided into ten equal plots. Owing to the fact that this year the product was small, the weights of the entire product only appear in the table. The names are arranged in the order in which the plots were located in 1896, the numbers at the left indicating the order in which the varieties mentioned stood in 1895.

Varieties.	Pounds of straw and grain, 1896.	Pounds of grain, 1895.
2. White Clauson	98	112.5
5. Red Clauson	29	72
6. Poole	25.5	50
8. Diehl-Mediterranean	39	15
7. Currell	9	8.5
1. Golden Chaff	95	164.5
3. Rudy	5.25	40.5
4. Egyptian	4	7
Schilf	0	
Buda Pesth	10	

It will be noticed that there is some variation in the order of productiveness of the varieties in the two years but the two varieties, White Clauson and Dawson's Golden Chaff, which stood much ahead of the others in 1895 are also far ahead in 1896. White Clauson is quite generally recognized as a variety well adapted to low or heavy lands where wheat is subject to winterkilling, and is particularly popular in Saginaw, Lapeer and adjacent counties where such lands are abundant. From the above trials, and other reports that have come to us, it appears probable that Dawson's Golden Chaff will prove equally hardy in such locations.

SMALL FRUIT TRIALS AT THE COLLEGE.

BY L. R. TAFT AND H. P. GLADDEN.

Bulletin No. 142.—Horticultural Department.

STRAWBERRIES.

The soil where the strawberries have been grown is not suitable for the best results. In some portions too much clay is found; other parts of the field have a quicksand bottom, but a short distance from the surface. Heavy applications of stable manure have been given and every effort made by frequent and thorough cultivation to get the land in as good tilth as possible. The past season has been favorable for both plant and fruit production, and as the spring setting was made on a plot of ground much better adapted to strawberries than the setting of 1895, more uniform results are looked for in the season of 1897.

As a rule, the yield of the perfect flowering varieties was very small. Although they blossomed profusely, few fruits developed. From the fact that the imperfect flowered varieties bore full crops, it seems probable that the plants were too much weakened by excessive pollen production to develop the fruit, rather than that there was any lack of potency in the pollen.

TABLE No. 1.—STRAWBERRIES.

ABBREVIATIONS.

Sex.
p, pistillate or imperfect.
b, bisexual or perfect.

Form.
b, broad.
c, conical.
d, depressed.
i, irregular.

Size.
s, small.
m, medium.
l, large.

Color.
b, bright.
c, crimson.
d, dark.
l, light.
r, red.
s, scarlet.

Variety.	Sex.	Vigor (1-10).	Date bloom.	Date first ripe fruits.	Date last picking.	Productiveness scale (1-10).	Size.	Form.	Color.	Quality.	Firmness.
Acem	b	9.8	May 7	May 26	June 15	6.5	s	r c	l s	9	7.5
Afton	p	9	" 7	" 29	" 15	9.5	m to l	l c	d c	9	8.8
Allen No. 1	p	8.5	" 11	" 26	" 17	5.0	m	r c	b c	9	8.5
" " 3	b	9	" 13	June 3	" 15	7.0	l	r c	b c	9	8.5
" " 6	p	9	" 11	May 29	" 15	5.5	s to m	b c	l c	8.5	8
Apache	b	7	" 7	" 26	" 15	7.0	m	l c	l s	5	8.5
Aroma	b	8	" 13	June 1	" 20	9.0	l	l c	l s	8.0	9.5
Beauty	b	6	" 7	May 29	" 15	8.5	l	r b c	b d s	8.5	8
Beder Wood	b	8	" 7	" 26	" 17	8.5	m	r d c	l s	8.0	8.5
Belle	b	7	" 7	June 1	" 17	9	m to l	l c	b s	8.0	9.0
Belle of La Crosse	p	8	" 7	May 29	" 17	8.5	l	r b c	b d s	8	8
Belt (Wm)	b	8	" 7	" 30	" 19	9	l	l c	l c	8.5	9
Bessie	p	7	" 11	" 26	" 17	8	m	l c	l c	8.5	9
Bird	p	8.5	" 7	" 29	" 19	8.8	l	l c	b d s	9	9.2
Bixler	b	10	" 11	" 29	" 15	7.5	m	r d c	l s	9.5	8.5
Bomba	b	7	" 7	" 26	" 15	7	m	c	d c	9	8.5
Bowman	b	7	" 7	" 26	" 17	7.5	m	r c	l c	8	8.5
Brandywine	b	8.5	" 11	" 29	" 19	8	l	r c	b d c	9.5	8.5
Brooke	p	7.5	" 12	June 1	" 15	8.5	l	b d c	d c	9.5	8.5
Brunette	p	5	" 13	" 1	" 15	6	m	r c	d c	9.5	8.5
Bryant	b	9	" 12	" 1	" 23	9	l	s d c	v d c	8.8	9.8
Bubach	p	8.8	" 14	May 29	" 15	8	l	d c	l c	9	8
Cameron No. 2	b	8.5	" 7	" 26	" 15	8	l	l c	b c	9	9
Carrie	p	8	" 7	" 29	" 15	9	m to l	l c	d c	8.5	8.5
Charlie	p	9	" 7	" 29	" 19	8.5	m	l c	b d s	9	8
Childs	b	9	" 6	" 26	" 19	8	l	d c	b c	9.5	9
Clark	b	7	" 13	" 26	" 15	7.5	l	r c i	d c	9	9
Clyde	b	9	" 7	" 26	" 21	9.8	l	r c	l c	8.5	9.2
Columbian	b	7	" 11	" 29	" 15	7.5	l	r c	l s	8.5	8.5
Crawford	b	9	" 11	" 29	" 21	9	l	r c	l c	9	8.5
Crescent	p	8	" 7	" 26	" 17	8.5	m	r d c	l c	8	9
Cyclone	b	10	" 6	" 26	" 19	8.5	m	l c	d c	9	9
Dan Bisel	b	9	" 7	" 26	" 17	9	m	l b c	b c	9	9
Earliest	b	9	" 6	" 19	" 4	7	m to l	r c	l s	7.5	7
Early Jack	b	9.5	" 6	" 23	" 17	7.5	s to m	i	b s	7	7
Edith	p	8	" 15	June 3	" 19	8.5	m	l b c	d c	9	9
Edward Favorite	b	7	" 11	" 1	" 21	8.5	l	r c	b d c	9.4	9
Engle No. 1	b	7.5	" 12	" 7	" 23	8.5	l	r c	l c	8	9
Enhance	b	10	" 11	" 2	" 19	8.5	l	b c	l c	8	9
Enormous	p	9.5	" 13	May 29	" 19	9.2	v l	r c	v b s	9	8.5
Epping	p	9.8	" 11	" 29	" 19	8.5	l	r d c	l s	8	9
Feicht No. 2	b	9	" 11	" 26	" 15	8	m	r c	l c	8	8.5
" " 3	p	10	" 11	June 1	" 21	8.5	l	i c	l c	8.8	8
Fred Stahelin	p	9.5	" 7	May 26	" 19	9.0	l	i c	v d c	9.5	8
Gandy	b	8.5	" 14	June 1	" 25	8	l	b c	l c	8.5	8.5
Gen. Putnam	p	9.8	" 7	May 29	" 15	8	l	b c	d c	8.5	8
Graham	b	8.5	" 11	" 29	" 15	8.8	m	r c	d c	7.5	9
Great Pacific	b	10	" 6	" 26	" 15	8.5	l	r c	l c	8.5	8
Greenville	p	9.8	" 11	" 29	" 19	9	l	r d c	b c	8.5	7.5
Haverland	p	9	" 7	" 26	" 21	8.5	m	l c	s	8.5	8.5
Holland	p	5	" 11	June 3	" 15	6.5	m	l b c	d c	9	9
Hall's No. 3	b	8	" 13	" 1	" 23	7.5	l	s d c	l s	9	8
Hunteman	b	8	" 11	" 1	" 17	8	m	r c	l c	8	8.5
Iowa Beauty	b	8	" 11	May 29	" 17	7.5	m	r c	d c	9.5	8.5
Jarbalo	p	8	" 7	" 26	" 15	8	m to l	r c	d c	7.5	8.5

TABLE No. 1.—STRAWBERRIES.—CONTINUED.

Variety.	Sex.	Vigor (1-10).	Date bloom.	Date first ripe fruits.	Date last picking.	Productiveness scale (1-10).	Size.	Form.	Color.	Quality.	Firmness.
Jay Gould	p	7.5	May 11	May 29.	June 15.	8	m	r c	b c	9.2	9.
Jones	b	8	" 7	" 26.	" 15.	9	l	d c	d c	9	8.5
Judsonia	b	8.5	" 12	" 29.	" 15	8	l	r b c	l c	7.5	7
Kansas Prolific	b	8.5	" 7	" 26.	" 15.	8.8	m	r c	d c	9.5	8.5
Kentucky	b	7	" 11	June 1.	" 26.	7.5	m to l	r d c	l s	8.5	8.5
Klickita	p	9	" 11	May 26.	" 21.	7.5	l	r d c	d s	9	7.5
Kossuth	b	9.4	" 13	June 1.	" 19.	8.5	l	r b c	d c	9.2	9
Kyle No. 1	b	9.5	" 13	May 29.	" 19.	8.0	m	r c	l s	6	6
Leroy	p	9	" 7	" 26.	" 21.	9.2	l	d c	d c	9	9
Lida	p	5	" 7	" 29.	" 15.	8.5	l	r c	d c	9	8.5
Lincoln	p	8	" 11	" 29.	" 21.	9	m to l	r c	l c	8	8.5
Longfield	p	10	" 7	" 29.	" 19.	9.5	l	r c	d c	9.2	9.4
Long John	b	8	" 7	" 29.	" 19.	8.5	l	v l c	b c	9	8.5
Lovett	b	8.5	" 12	" 29.	" 21.	8.5	m	r c	b c	8	9.
Luther	b	6	" 11	" 26.	" 15.	8.5	s to m	l c	b s	9.5	8.4
Marshall	b	9	" 12	June 1.	" 23.	8.5	l	r c	d c	8.5	9.
Mary	p	7.5	" 16	" 5.	" 23.	8	l	b d c	b c	7	9
Maxwell	pb	9	" 12	" 1.	" 21.	8.5	m	r c	d c	9.8	9.5
Meek	b	8	" 13	May 29.	" 15.	8	m	r c	l c	8.5	8.8
Meridian	p	7	" 11	" 29.	" 17.	8.8	l	r c	d c	7.5	8.
Middlefield	p	9	" 12	" 29.	" 21.	8.5	m	r c	l c	8.5	8.5
Miner	b	8.5	" 11	" 29	" 19.	8.	l	c	d s	8	7.5
Mrs. Cleveland	p	9	" 12	" 26.	" 17.	8.5	m	r b c	b s	8	8
No. 4 (J. S.)	p	9	" 12	" 29.	" 15.	8	l	r c	l c	8	8.5
No. 6 (J. S.)	p	8.5	" 12	June 3.	" 25.	9	l	r c	d c	9.8	9
No. 16 (S. & B.)	b	8	" 7	May 29.	" 15.	8	l c	r c	d s	8	8.5
No Name	b	10	" 13	" 26.	" 17.	8	l	b c	d c	9	9
Ona	p	9	" 12	" 29.	" 15.	8.5	m to l	s r c	b d s	9.8	8.5
Orono	p	9.2	" 3	June 3.	" 19.	7	l	r c	v d c	8.5	9.
Oscar	b	8.8	" 13	" 2.	" 19.	7	l	r c	v d c	9.	9.5
Ostego	p	9	" 13	May 29.	" 21.	7	m to l	r d c	l s	8	8
Paris King	b	5	" 11	" 29.	" 17.	6	l	c	d s	8.5	8.5
Parker Earle	b	8.5	" 11	June 3.	" 25	9	m	l c	d s	8.	9
Phillip	b	10	" 12	May 28.	" 19.	8	l	r c	d c	7.	7
Princeton Chief	p	9.8	" 13	June 3.	" 19.	8	l	l c	d c	8.5	8.8
Princess	p	8.5	" 12	" 1.	" 17.	8	m	r	c	9	8.5
Richmond	b	7.5	" 11	" 1.	" 19.	8.5	l	b c	d c	9.5	8.5
Rio	b	9	" 13	May 26.	" 15.	7.5	m	l c	b s	9	7.5
Robinson	b	9	" 7	" 29.	" 19.	9	m	r c	b c	6	6
Roser No. 1	b	9.8	" 6	" 26.	" 19.	8	m	r c	d c	8	8.5
Sadie	p	9	" 6	" 24.	" 15.	9	m	r c	d c	9	8
Sandoval	b	6	" 12	" 29.	" 19	8.5	l	r d c	v d c	8.5	9
Seedling B	b	9	" 12	" 29.	" 21.	8.5	l	r c	s	7.5	7
Shawnee	p	7	" 12	June 3.	" 17.	8.5	m	l c	d c	8.5	8
Sherman	p	7	" 6	May 28	" 15.	9.5	l	r c	d c	8.5	9
Shuckless	b	8	" 13	" 29	" 23.	8.5	l	r c	d c	7	7
Smalley	p	8	" 7	" 29.	" 21.	9.4	m to l	r c	d c	7.5	9.8
Snowball	b	9.5	" 7	" 26.	" 23.	9	l	l c	b s	8	9
Splendid	b	9	" 11	" 29.	" 17.	8.5	m	s d c	d s	9	9
Springdale	b	9	" 12	June 1.	" 17.	8.5	l	r c-l c	b s	8	8
Standard	b	7	" 13	May 29.	" 19	8.5	l	r c	d c	9	8
Staples	b	8.5	" 7	" 24.	" 15.	6	s	l c	v d c	9	8.5
Sunnyside	p	8.8	" 11	" 29.	" 21.	8.5	l	b c	l s	8.5	8
Surprise	b	8	" 12	" 29.	" 17.	8	l	l c	b s	8	8.5
Swindle	p	8	" 7	" 26.	" 21.	6	m	r c	c	7	9

TABLE No. 1.—STRAWBERRIES.—CONCLUDED.

Variety.	Sex.	Vigor (1-10).	Date bloom.	Date first ripe fruits.	Date last picking.	Productiveness scale (1-10).	Size.	Form.	Color.	Quality.	Firmness.
Tennessee Prolific	b	7	May 12	May 29.	June 15.	7	m to l	r c	d c	9.5	9
Thompson No. 24	p	8.5	" 12	" 29.	" 19.	9	m	r c	b c	8	8
" " 40	p	9.5	" 11	June 1.	" 22.	9.5	m	r c	b c	8.5	8.5
" " 64	p	7.5	" 7	May 29.	" 15.	8	m to l	i r c	b d s	8.5	9
" " 66	p	8.5	" 12	" 29.	" 15.	8.5	l	l c	b d c	8	8
" " 108	b	8.5	" 7	" 26.	" 17.	9	l	r d c	v d c	9.4	9.8
Timbrell	p	6	" 11	June 1.	" 22.	8	l	r c	v d c	8.5	8
Tonga	p	8.5	" 12	" 1.	" 17.	8.5	m	i r c	s	8	9
Topeka	b	8.5	" 7	May 29.	" 21.	9	m to l	l c	d c	8	8.5
Warfield	p	9.8	" 7	" 24.	" 15.	9	m	l c	d c	8.5	9
Weston	p	8.5	" 12	June 1.	" 21.	8.5	l	b c	b c	8	8.5
Williams	b	8	" 11	May 29.	" 15.	8.5	m to l	r c	d c	9.5	8.5
Woolverton	b	7.5	" 12	" 29	" 17.	8.5	m	l c	d c	8	9
Wyatt	b	7	" 7	" 29.	" 15	8.8	m	r c	d c	9.5	8.5
Yates	b	9.2	" 6	" 26.	" 15.	7	l	r b c	l s	9	7
Zola	b	5	" 6	" 26.	" 15.	8.8	m	l c	d c	9	8

The following sorts fruited for the first time on the college grounds during the past season:

Acem. Perfect. Plants received from John Little, Granton, Ontario. Plants of very strong growth, blossomed full, but few blossoms set fruit and the berries were very small and imperfectly formed. The quality is good but the berry is soft. Needs further trial.

Apache. Perfect. Plants from Stayman & Black, Leavenworth, Kan. Blossomed very full but little fruit set. The fruit is long conical in form, color light scarlet, seeds prominent, flesh light and very poor in quality. Fruits develop imperfectly. Worthless from this season's trial.

Brooke Seedling. Imperfect. Plants from F. W. Brooke, Ithaca, Mich. The plants are growing in a poor location, hence vigor of growth and productiveness cannot properly be determined. Set well with fruit for plant growth. The fruit is large, broad, depressed conical in form, dark crimson color, seeds yellow, flesh very dark and of high quality, moderately firm. Size of berry holds out well to close of season. The handsome appearance and high quality of the fruit and the promise shown in growth and productiveness speak well for the future of this sort.

Bryant. Perfect. Plants from Birdseye & Son, Hopewell, N. Y. Plants of strong growth, healthy. Blossomed full and set well with fruit. Berry of large size, short, depressed conical, somewhat irregular in form, very dark crimson color, flesh dark and of fair quality, though somewhat acid, very firm. A very promising market sort.

Carrie. Imperfect. Plants from Thompson's Sons, Rio Vista, Va. Plants did not show up well last fall but the spring growth was good. Fruit medium to large in size, long conical form, dark crimson color, quality fair and moderately firm. Last fruits often imperfect. In poor location and but few plants. Must try again to judge properly.

Columbian. Perfect. Plants from Slaymaker & Son, Dover, Del. Plants of low, stocky, vigorous growth. Few blossoms came out but most of them set fruit. Berry large, round short conical form, light scarlet

color, flesh light and fair in quality, moderately firm. But few plants, scarcely enough to judge fairly of the variety.

Earliest. Perfect. Plants from Thompson's Sons. Plant of very strong, vigorous growth. Blossomed very full but did not set much fruit. This was the first variety to ripen fruits. First berries very large, round conical form, light scarlet color, flesh light and of poor quality; most of the fruits are hollow and soft. A seedling of Michel's, and like its parent good for but one or two pickings, after which it produces only small and imperfectly formed fruits. If valuable at all it is only so for its extreme earliness.

Enormous. Imperfect. Plants from W. F. Allen, Jr., Salisbury, Md. Plants of very strong, upright, vigorous growth. Fruit very large in size, short round conical form, very bright scarlet color, good quality and moderately firm. Valuable for vigor of plant growth and productiveness, for the handsome appearance, good quality and moderate firmness of berry. A sort of much promise.

Graham. Perfect. Plants received from C. W. Graham, Afton, N. Y. Plants of fair growth. Many blossoms failed to set fruit. Berry of medium size, round conical form; flesh dark, juicy, but quite acid, firm. Last fruits are small in size. Berry parts too easily from calyx. Not of special merit, though worthy of trial.

Holland. Imperfect. Plants from L. J. Farmer, Pulaski, N. Y. Plants are scattering, were filled in last fall and did not get well started. A few plants set a moderate amount of fruit. Berry long, somewhat broad conical in form, dark crimson color, flesh dark, of good quality and firm. Fruits do not ripen well on unexposed side. Needs further trial.

Hull's No. 3. Perfect. Plants from E. J. Hull, Olyphant, Pa. Plants are of low, healthy growth; blossomed very full but the largest proportion failed to set fruits. Fruit large, short depressed conical form, light scarlet color, flesh pink, of good quality and moderately firm. Berries ripen evenly but are light colored. No qualities of special prominence.

Jarbalo. Imperfect. From Stayman & Black, Leavenworth, Kan. Plants are not in good location but still vigorous. Fruit medium to large in size, round conical form, color dull scarlet, not of high quality and moderately firm. Fruit lacking in attractive appearance and quality. Under better conditions would be a sort of some promise.

Kansas (Prolific). Perfect. Received from Stayman & Black. Plants are scattering in row, in a poor location, but are much ahead of any other variety near them under similar conditions. Blossomed full and set well with fruit for plant growth. Fruit of good size, round, conical form, dark crimson color, high quality and moderately firm. Promising, but needs further trial under more favorable conditions.

Kossuth. Perfect. From Stayman & Black. Plants of good growth, blossomed full and set a fair crop of fruit. Berry large in size, irregular, depressed broad conical form, dark crimson color. Flesh dark, of excellent quality and firm. Promising for market or home use, because of handsome appearance, high quality and firmness of berry. Productive.

Mary. Imperfect. Plants received from Edw. W. Cone, Menominee, Wisconsin. Plants are not of strong growth. Fruit large, form broad, depressed conical, color bright crimson, firm but very acid. The decided sourness of the berry is a strong point against it.

Meridian. Imperfect. Sent by Stayman & Black. Plants quite strong and vigorous and set well with fruit. Berry large in size, round conical

form, dark, somewhat dull crimson in color, flesh dark but rather coarse, lacking juice and quality, moderately firm. Valuable for lateness in ripening bulk of crop, regular size and form. Lacks quality.

Ona. Imperfect. From Edw. W. Cone. Plants of strong, healthy growth. Fruits medium to large in size, short round conical form, regular, color a bright dark scarlet, seeds yellow, prominent, flesh dark, juicy, of high quality and quite firm. Its handsome appearance and its high quality and firmness make it worthy of trial for home or market use. In productiveness, however, it is but little above medium.

Orono. Imperfect. Plants received from John Little, Granton, Ont. Plants of strong, healthy growth. Fruit large, round conical, bright dark crimson color, quality good and flesh firm. Very attractive in appearance, and its quality and firmness are well up, but so far the sort has not made a good showing in productiveness.

Oscar. Perfect. Plants from Thompson's Sons. Plants of low stocky growth and very healthy. Fruit large, round conical form, often irregular, very dark crimson color, seeds yellow, large and prominent; flesh very dark, good quality and firmness with the best. It would be an excellent market sort if more productive, because of attractive appearance, good quality and firmness.

Ostego. Imperfect. Received from Thompson's Sons. Plants of fair growth, did not blossom very full but set well with fruit, some berries imperfect. Fruit of good size, round depressed conical, regular form, light scarlet color, seeds sunken, flesh light and lacking flavor. Not of special merit.

Paris King. Perfect. Plants received from W. F. Allen. Growth in row scattering, individual plants fair. Few blossoms but set well with fruit. Berry large, round conical, dull scarlet color, flesh light, of fair quality and firmness. Its color is against it and it seems to lack productiveness. Further trial is necessary to form an opinion.

Sherman. Nearly imperfect. From Edw. W. Cone. Plants of low growth, foliage very dark green. Blossomed very full and set a large amount of fruit. Berry large, short round conical form, dark crimson color, seeds dark, thickly set, prominent, flesh rather light, of fair quality and firm. Fruit does not ripen well at tip and often imperfect there. Plants have not foliage enough to develop and cover fruit properly, though lack of plant growth may be largely due to poor location. A very productive sort.

Smalley. Imperfect. Plants from C. W. Graham, Afton, N. Y. Plants are of low, stocky growth and healthy. Berry medium to large in size, form regular round conical, color dark, somewhat dull crimson, flesh dark juicy, acid but very firm. Ranks high in productiveness, is of fair appearance and the berry would stand shipment well. Promising as a market sort.

Splendid. Weakly perfect. From Matthew Crawford, Cuyahoga Falls, Ohio. Plants of low growth but strong and healthy. Berry below medium size, short depressed conical form, color dull scarlet, flavor quite acid but good, firm. Lacking in size of berry and attractive appearance, otherwise good. Try again.

Staples. Perfect. Received from Crawford and Cone. Plants of good growth. Blossomed full but few fruits set and most of those imperfect. Needs further trial.

Thompson No. 103. Perfect. Plants from Thompson's Sons. Plants of excellent growth, blossomed full and set a large amount of fruit. Berry large, round, depressed conical; color, very dark crimson; flesh, dark, juicy and of good quality, quite firm. The plants are productive, the berry of good size and appearance, ripens well and is of fine quality. A promising sort.

Wyatt. Perfect. Received from Ezra G. Smith, Manchester, N. Y. Growth good for location. Blossomed full and set a large amount of fruit. Berry of medium size, round, conical form, dull crimson color, excellent quality and quite firm. Last of crop rather small and some berries did not develop. Regular form and fruit of high quality. Promising.

Yates. Perfect. Plants from Stayman & Black. A strong, vigorous grower. Blossomed full but failed to set much fruit. Berry large, round or broad conical, light scarlet color, flesh light and of mild flavor, soft and berries often hollow. Color against it, too soft and rots at tip before ripening.

Zula. Perfect. From Stayman & Black. In poor location, plants did not get a good start. Blossomed very full and set a large amount of fruit for plant growth. Berry of medium size, long conical form, dark crimson color, flesh dark of good quality and moderately firm. In color, form and quality this variety ranks high. Scarcely enough of plant growth to judge of productiveness.

NEW VARIETIES OF 1896.

Aroma has shown itself to be a valuable market sort. The plants are productive, the berries are large to the end of a long season and are firm enough to stand shipment well. Its season is with the later sorts.

Bixler did not set well with fruit. The plant is one of the best growers in the patch and the fruit is of very high quality. It is bisexual and the season was adverse for fruit setting.

Cyclone is valuable for good appearance, high quality and firmness of berry, and for vigor of plant growth.

Early Jack fruits turn dull yellow and rot before ripening; poor in quality and soft. Early, but of no particular value.

Edith. Season late. Berry large, of good quality and firm. Holds out well in size to close of season.

Fred Stahelin. A most promising sort for home use or near market, because of the handsome appearance and high quality of the fruit. Productive, but last fruits are small.

Kyle No. 1. The fruit is soft and of poor quality. Hulls easily and is dry at place of parting. The fruit truss is upright and the berries are borne beyond leaves, so easily injured by frost and sun.

Longfield again proves itself a very promising market sort, will stand shipment well and is attractive in appearance. It ranks among the first in productiveness and the plants are fine growers.

Marshall. Another season's trial of this sort confirms the good opinion we have formerly expressed. The large uniform size of the berry and its good quality and firmness make it a good home and market variety. The larger fruits are inclined to be irregular and the plants are subject to rust.

Maxwell did not set so well with fruit as the previous season, probably on account of its being nearly bisexual. The berry is attractive in appearance and of very high quality and firmness. It is quite sure to reach a prominent place.

No Name is of the strongest growth though scarcely up to the standard in productiveness. The berry is very handsome in appearance and high in quality and firmness. Seems to be a sort of some promise.

Phillip failed to set fruit well and many of the berries were imperfect. The berry is attractive in appearance but is not of high quality and it lacks firmness. Probably will not occupy a very prominent place.

Rio made an excellent showing last year; this season the crop was small in both size of berry and quantity produced.

Robinson lacks quality and firmness of berry, otherwise it takes high rank.

Shawnee ripens slowly and unevenly but otherwise it is a variety of some promise.

Shuckless parts from calyx easily, though no more so than Kyle No. 1. Berry dull in color, of coarse texture and lacking juice, though the quality is fair. Of little promise.

Snowball is of strong, healthy growth and the plants are productive. The fruit is handsome in appearance and a good shipper. A very promising market sort.

Springdale plants are of good growth; the berry is of fine appearance, though scarcely as firm as last season. A good sort, though nothing to give it special prominence.

Tennessee Prolific are in a poor location but set well with fruit in proportion to plant growth. The berry is attractive in form and color, of high quality and quite firm. If the variety proves productive it will be a valuable sort.

Timbrell, because of unevenness in ripening and spotted appearance of fruit will not occupy a prominent position among the many better new sorts now before the public.

Thompson's Nos. 40 and 64 have again shown themselves to be valuable sorts. No. 40 is particularly promising for the handsome appearance of the fruit and the vigorous growth and productiveness of the plants.

Tonga set well with fruit, but the berries do not ripen well, are irregular in form and dull in color. Further trial necessary.

Of the older sorts and among those tested for several seasons the following are worthy of special mention:

Clyde. Though we have grown this sort for several years and considered it to have considerable promise, it was not until the past season that it showed up remarkably well. While the plants are not of strongest growth, yet they bore the largest crop of any variety in the field. The berries are of good size and very regular in form. The color is rather light and the flesh is less firm than desirable. If it continues to be as productive as during the past season, it will be a profitable market variety.

Wm. Belt is another variety that has shown up much better than in previous seasons. The berry is large, of good form and color and is firm enough to stand shipment well.

Bird, Greenville, Leroy, Weston and Williams are excellent in plant forming properties and the berries make a good appearance in market. As these sorts rank high in productiveness, they are well worthy of trial in comparison with the older market varieties. Epping is a little light in color, otherwise a fine market sort.

Varieties for home use or near market should be strong in plant growth, productive, attractive in appearance and high in quality. Belle of Lacrosse, Brandywine, Brunette, Huntsman, Iowa Beauty, Mrs. Cleveland,

Princeton Chief and Topeka possess the above qualities and are recommended for the purpose named. Bubach, Crescent, Haverland and Warfield are yet the leading imperfect flowering sorts planted by the general grower. Beder Wood, Sharpless, Wilson and Woolverton are excellent pollenizers for the above sorts and are also valuable market berries. Belle, Gandy and Parker Earle are among the best late ripening varieties.

Many varieties, of which no special mention is made, are sorts of considerable merit and possess qualities that under other conditions might place them in the front rank.

RASPBERRIES.

The drouth of last summer together with the extreme cold of the winter left the canes in so weakened a condition that the anthracnose could not be kept wholly in check. Cuthbert and most of the red sorts were killed nearly to the ground. Many varieties suffered severely in decreased productiveness and in the smaller size of the berries.

TABLE No. 2.—BLACK AND HYBRID RASPBERRIES.

ABBREVIATIONS.

Size.	Form.	Color.	
s, small.	r, round.	b, black.	g, glossy.
m, medium.	c, conical.	p, purple.	l, light.
l, large.	o, ovate.	o, orange.	pu, pubescent

Variety.	Per cent of winter injury.	Date bloom.	Date ripe.	Productiveness (1-10).	Size.	Form.	Color.	Quality.
Ada	.20	May 23.	June 24.	6.5	m	r	g b	8
Caroline	.35	" 28.	" 24.	7.0	m	r	l o	8
Columbian	.50	June 1	July 2.	8.0	l	r o	p	8.5
Conrath	.3)	May 20.	June 24.	9.5	l	r	b	8
Cromwell	.85	" 20.	" 28.	5.0	m	r	b	8
Ebon Beauty	.50	" 22.	" 24.	5.0	m	r c	b	7
Farnsworth	.20	" 19.	" 22.	9.2	l	r	b	8.5
Gregg	.50	" 22.	" 26.	8.5	l	r	b pu	7
Green's New Raspberry	.25	" 22.	" 26	.	l	r	b pu	9
Hopkins	.70	" 21.	" 22.	6.0	m	r	b	8.5
Kansas	.20	" 20.	" 24.	9.7	l	r	g b	8.5
Lovett	.50	" 18.	" 24.	8.5	m	r	b	8.
May King	.20	" 20	" 24	5.5	s	r o	b	7.5
Mills' No. 15	.25	" 20	" 25.	..	......	.....	---	.....
Nemaha	.75	" 25	" 28.	8 0	l	r	b pu	7
Ohio	.35	" 19.	" 24.	8.5	l	r	b	6
Older	.20	" 22.	" 24	9.2	l	r	b	9
Palmer	.50	" 18.	" 18	8.5	m	r	b	8.5
Progress	.65	" 20.	" 22.	5.0	s	r	b	8.5
Shaffer	.75	June 1.	" 28.	7.8	l	r s	p	8.5
Smith	.75	May 22.	" 20.	5.0	l	r	b	9
Virginia	.85	" 18.	" 22.	7.0	l	r o	b	8.5
Winona	.85	" 20.	" 24.	8.2	m	r	b	8

NOTES ON VARIETIES.

Ada did not make so good a showing this season as in the previous one. The canes made a weak growth and were badly attacked with anthracnose.

Caroline. The fruit is a dull yellow color and rather insipid in flavor; too soft for market.

Columbian. A variety resembling Shaffer somewhat in general characteristics, but its cane growth is stronger and the berries are firmer and a little better in quality. As grown here it slightly leads Shaffer in productiveness.

Conrath. We have grown this variety for several seasons and have found it uniformly productive. The berries are large in size, the quality good, and they hold out well. The canes were healthy, but little disease showing. Its season is medium early.

Farnsworth. This variety stood the winter well and was quite free from disease. The fruit is large, firm and of good quality. An excellent variety for home use or market.

Gregg. The best late market sort. The canes are lacking in hardiness, and it should only be placed in high, well-drained soil.

Green's New Raspberry. This was the first season of fruiting. The growth is healthy. Berries of good size, deep black in color with some fuzz; seeds small. The fruit is not very firm but is of high quality. Not enough growth or fruit to judge of merits.

Kansas. For another season this was the most productive black cap grown. The canes were hardy and but little troubled with disease. The fruit is large, of fine appearance, and firm though not of best quality. One of the best medium season market berries.

Lovett. The canes are not hardy and are quite subject to anthracnose. The bushes bore a fair crop of fruit but the berries were small and lacking in flavor.

Mills' No. 15. Fruited for the first time this season. Fruit is large, jet black in color with some bloom, the seeds are small. In season a little earlier than Gregg; berry not as large, with less bloom, not so dry or so firm, but better in quality. The bushes are of good growth, healthy and productive. It is a promising variety.

Ohio. The leading variety for evaporating purposes.

Older. This variety is very vigorous and healthy in cane growth, and bears a large crop of fruit which holds its large size to close of season. If the berry were firmer it would make a most excellent market sort. Valuable for home use or near market.

Palmer. One of the best early market sorts.

Shaffer. For canning and home use this variety has few superiors among the better known sorts. The canes were badly injured by winter and anthracnose, and this is a common failing of the variety.

Winona. This variety made but little cane growth during the season, though bearing a fair crop of fruit. The variety seems to possess no prominent qualities, but will be given further trial.

Cromwell, Ebon Beauty, Hopkins, Jackson's May King, Progress, Smith, and Virginia, were weak in cane growth, badly affected with anthracnose, and bore but a small crop of fruit.

TABLE No. 3.—RED RASPBERRIES.

ABBREVIATIONS.

Size.	Form.	Color.	
s, small.	r, round.	d, dark.	o, orange.
m, medium.	c, conical.	r, red.	b, bright.
l, large.	o, ovate.	p, purple.	

Variety.	Per cent of winter injury.	Date bloom.	Date ripe.	Productiveness (1-10).	Size.	Form.	Color.	Quality.
Cuthbert	.65	June 4.	June 24.	8.8	l	r c	r	8.0
Gladstone	.80	May 29.	" 22.	5.0	s	r c	d p	8.0
Golden Queen	.70	June 2.	" 26.	5.0	l	r c	o	9.5
Hansell	.50	May 26.	" 23.	6.0	m	r	d r	9
Kenyon	.35	June 1.	July 10.	....	l	r c	d c	9.5
King	.35	May 23.	June 22.	6.5	....	....	....	....
Loudon	.25	" 30.	July 10	....	l	r c	d c	9.5
Marlboro	.50	" 28.	June 23.	6.0	m	r	r	8.5
Michigan Early	.25	" 26.	" 17.	7.0	m	r	r	9.0
Miller	.25	" 30.	" 28.		l	r c	b r	9
Nameless	.80	July 1.	" 22	6.5	m	r	r	8.5
Perry's Golden	.75	May 27.	" 24	6.5	l	r c	o	9.5
Philadelphia	.50	" 25.	" 24.	5.0	l	r c	d r	9.5
Royal Church	.75	" 27	" 26.	5.5	l	r c	d c	8.5
Stayman No. 1	.70	" 31.	July 16		l	r c	d c	9
Thompson	.75	" 25.	June 21.	5.0	m	r	d r	9.0
Turner	.20	" 23	" 20	8.0	l	c	r	9.0

NOTES ON VARIETIES.

Cuthbert. Though somewhat injured by winter and anthracnose, this variety bore a fair crop, and it has no superior for general planting.

Gladstone. This variety was very disappointing the past season. The autumn crop was ruined by frost before maturing. Has a place as a novelty.

Golden Queen and *Perry's Golden* are quite similar in bush and fruit. They are valuable as dessert varieties.

Hansell and *Michigan Early* may find a place to a limited extent as early ripening sorts.

Kenyon. New. Canes large and stout, and nearly free from spines; leaflets are large, broad, of a dark green color and quite far apart on canes. The fruit is large, round conical, rich dark red color and of high quality. The berry is very attractive in appearance and firm. As it ripened this season it was a week later than Cuthbert. For the strength of the plants the crop was a large one.

Loudon. New. As close a comparison as it was possible to make between Loudon and Kenyon shows them to be nearly, if not quite, identical in cane growth and fruit. Both sorts were planted quite late in the spring of the previous year and the growth was not large nor the fruits abundant. Perhaps another year's growth may bring out some differences. The plants are quite hardy, and it is a very promising variety, either for home use or market.

King. New. Scarcely enough cane growth and fruit to judge properly of this variety. Closely resembles Hansell.

Marlboro. Canes of small growth and quite badly diseased. Usually productive and largely planted as an early berry.

Royal Church. The fruits are of a dark, rich red color, very handsome in appearance, and of good quality, but crumble so easily that they are picked with difficulty. The bushes are moderately productive.

Stayman No. 1. New. Canes of strong, healthy growth, and thickly set with short, stiff spines. Foliage closely of *Idæus* type. The leaflets are very large, and being set very close, nearly cover the entire cane. Berries large, short round conical in form, and of a bright dark red color. It is quite acid in quality, but pleasant. The fruits are a little inclined to crumble. Judging from the first fruiting it promises to be very productive. The season is late.

Turner. The bush is hardy. The fruit soft but of high quality. Valuable for home use or for near market.

BLACKBERRIES.

The winter of 1895–6 was so severe as to kill the canes of many varieties to the ground. No variety produced more then one-tenth of a crop. The following partial notes may have some value in determining the hardiness and adaptation of certain sorts to our climate.

Eldorado stood the winter best of any sort grown, but the fruits borne were so imperfect and small in quantity that no definite results as to the fruiting qualities could be obtained. That it is equally as hardy as Snyder has been well shown by the severe tests of the two past seasons.

Taylor and *Snyder* were the two other sorts on which, it could be said, fruits were borne, but the yield was very small.

The following sorts bore a few small, imperfect berries: *Early Cluster, Erie, Lincoln, Minnewaski, Ohmer, Stone's Hardy, Thompson's Mammoth,* and *Wilson, Jr.*

Agawam, Childs' Everbearing, Early Harvest, Early King, Ford's No. 1, Jewett, Kittatinny, Lovett's Best, Maxwell, Wachusett, White Blackberry and *Wilson's Early* bore no fruits.

Lucretia dewberry, because of its trailing habit, stood the winter better than did the blackberries. It did not bear a full crop, but the berries were very large, and, while quite acid, were still pleasant in flavor.

GRAPES.

The College vineyard comprises over one hundred varieties. Many have not yet fruited. Owing to the numerous depredations committed, it was impossible to get complete notes on the time of ripening, quality and productiveness of all the varieties. The following are, therefore, not as full or as valuable as they would otherwise be.

NOTES ON VARIETIES.

Berckmans. Clusters are small in size, flat at base and rounding to apex where grapes are set closest. Grape is medium in size, round or slightly oblate, not firmly attached to stem, but does not drop easily, color a rich, purplish red. The quality is high and both vine and cluster were free from disease. Season with Concord.

Black Pearl. Bunches will average small, though many are of fair size; very irregular in shape. Grapes are small, round, set close with short stems; color blue-black. The pulp is tough and very acid. The cane and foliage are healthy and the variety was the most productive in the vineyard. Season middle of September.

Brighton. Usually considered one of the best red grapes for home use or market. This season the clusters were small and nearly every grape cracked and dropped off before fully ripening. Season with Concord.

Cottage. Clusters short and close. Grape is medium in size, round, blue-black color; the skin is tough and the pulp solid and of good quality. The variety is healthy in plant and fruit, but the clusters are too small, the grape is lacking in juice and drops too easily from stem. Season a week earlier than Concord.

Early Dawn. Clusters small, single stemmed and closely set with grapes. Berry of medium size, light-red in color, with thin, almost transparent skin. The canes are fairly productive of small clusters and the quality is very fine; the grapes however, crack and drop badly if not picked as soon as ripe. A week earlier than Concord.

Early Victor. The canes are of good growth and bear a fair crop of small sized clusters. The grapes are blue-black in color and of fair quality. The variety is one of the earliest and has a place in the family vineyard. Season, two weeks earlier than Concord.

Geneva. Cluster of medium size, single stem with grapes set evenly and closely, making an attractive bunch. Berry is of good size, round, light-green color and of high quality. The vine and fruit is healthy and the grapes do not crack, but hang firmly to the stem. The variety is scarcely productive enough for a market sort, but its early ripening, good appearance and high quality make a place for it in the family vineyard. A week earlier than Concord.

Hayes. Cluster of medium size, well-formed and close. The grape has a thin skin and cracks easily; color a light golden yellow. In quality it is sweet and melting, very fine. If more productive and the vine a better grower, it would take rank among the first table sorts. A week earlier than Concord.

Jewell. Very healthy and productive, though clusters are small. The berry is small to medium in size, blue-black in color with considerable bloom, pulp rather tough but of good quality. Cluster and grape too small. Season of Concord.

Martha. Vine healthy and productive of some fine clusters. Berry of medium size, round, light-green in color. The quality is good, but quite foxy. The variety is rather late in ripening. A week later than Concord.

Massasoit. The canes were unproductive and the clusters small. Considerable mildew and anthracnose made an appearance and the berries dropped. Season with Concord.

Moore Early. Cane growth strong. Healthy in foliage and fruit. Quite certain to make large, well-formed bunches. One of the best early market black grapes. Two to three weeks earlier than Concord.

Moyer. The grape is of very fine quality, but only imperfect clusters were formed. The grapes cracked and dropped before ripening. Season of Concord.

Niagara. This is the leading white market grape. The canes are strong growth and productive and the fruit and foliage usually free from disease. A little later than Concord.

Rochester. Cluster short, compact, well rounded at end and usually with a well developed shoulder. Grape of medium size, oblate, with short stem and strong attachment. Did not ripen sufficiently to judge of color and quality. A few days earlier than Concord.

Rockwood. Clusters quite large, not shouldered, close and compact. Berry of medium size, round, color a deep blue-black, skin thick and tough, pulp rather coarse and lacking in juice, but of fair quality. The vine is healthy, of strong growth and productive. The bunch is of good size and form and the berry will stand shipment well, does not drop from stem. The season is early. A good market grape. Season a few days later than Moore Early.

Winchell. Clusters of good size, often quite double, close. Berry of medium size, round, light-green, skin thin and often cracks before ripening, pulp sweet, melting and of very fine quality. The variety is early in ripening, productive and is one of the best white grapes for the home vineyard. A few days later than Moore Early.

Worden. This variety is from a week to ten days earlier than Concord. The vines are vigorous, healthy and productive. The grape is of better quality than the Concord. The variety has a place in every vineyard whether planted for home use or market.

NOVELTIES.

During the past three or four years several new varieties of fruits have been placed upon the market that are either hybrids or of species that have not before been cultivated in this country. Most of them have been tested here, and thus far none have shown promise of value for any purpose whatever. The following are the varieties tested:

Mayberry (*Japanese Golden*). The plant resembles the red raspberry, and was raised by Luther Burbank by crossing *Rubus palmatus* and the Cuthbert raspberry. It is claimed by the disseminators to form a bush six or seven feet high, and the fruit is said to ripen a month before the earliest raspberries. We have made two attempts to test this variety, but in both cases the plants failed to grow. Those obtained last spring were from southern New Jersey, but the tops had been killed to the ground by the winter, and the roots were too weak to send up shoots. Judging from this experience the plant will not stand our climate.

Loganberry (Raspberry x Blackberry). This is supposed to be a hybrid between the Aughinbaugh, a California blackberry and Red Antwerp raspberry. The plants are spreading and the leaves and canes greatly resemble the European raspberry, the latter being covered with prickles. The fruits resemble the blackberry in shape and structure, but are red when ripe. The plants seem about as hardy as our common

varieties of blackberries, and they formed a few fruits last year on two year old plants, but they have shown no valuable characteristics.

Strawberry-Raspberry (*Rubus sorbifolius*). This is a recent novelty from Japan. It sends up stems to the height of twelve or fifteen inches, which are covered with short, stout spines, as are the ribs of the leaves. The old stems die down each year and new ones are sent up from the roots. As grown here it seems to have no value, and as it suckers profusely it may become difficult to eradicate when it has obtained a hold of the soil.

Wineberry (*Rubus Phœnicolasius*). Another Japanese species introduced and quite widely disseminated several years ago. It seems to be wanting in hardiness as it has killed to the ground nearly every year. The canes are somewhat spreading, and are covered with numerous reddish, purple hairs. The calyx is quite large and thick, and forms a sort of burr about the berry. The fruit is of a dark amber color, and is soft and rather acid. Of no value except as a curiosity.

AGRICULTURAL COLLEGE, MICH.,
January 1, 1897.

FRUIT TESTS AT SOUTH HAVEN.

REPORT BY T. T. LYON.

Bulletin No. 143.—Horticultural Department.

To Prof. L. R. Taft, Horticulturist:

SIR—As during the years 1894 and 1895, so during the spring of 1896 there was no adequate rainfall in this immediate vicinity until the middle of July. This necessitated hauling water by team for irrigating such plants as were not yet well established. This continued until July 7th, at which date the mains of the village water works became available, and a permanent supply upon the premises was secured, although the use of a team with barrels was yet necessary when water was to be applied beyond the reach of a hose. Since the occurrence of the copious rains, above referred to, however, resort to the artificial application of water has rarely been found necessary.

For the double purpose of subduing weeds and maintaining a surface mulch of mellow earth, free use has been made of the Acme cultivator among the older trees, and of a fine toothed one, or a Planet, Jr., among younger trees and small fruit plants, especially after the occurrence of rain. This was continued until about the middle of August, after which all cultivation was discontinued, except in a few special cases.

The entire plantation was sprayed in early spring, while growth was yet dormant, with a solution of a pound of copper sulphate in twenty-five gallons of water. This was applied to gooseberries and currants (which start very early) on March 10th, and to all other small fruits prior to April 17th. For the purpose of comparison, only alternate trees of the cherries, peaches and plums, in the southwest block were treated, commencing with the first. Later examination shows a slight difference only, in favor of the sprayed trees, in a few cases.

Subsequent sprays were applied at sundry times during the season for various purposes. These will be noticed under the heads of the several fruits to which such applications were made.

The rules of pomology of the American Pomological Society (which are also the rules of the National Division of Pomology), are rigidly applied in the nomenclature of fruits, objectionable words being added in brackets only when deemed needful to avoid ambiguity, but with the hope that ultimately they may be wholly omitted, in the interest of simplicity, brevity and correct taste.

The weight, in ounces, of an average specimen of each variety is given as indicating the comparative importance thereof; this being deemed to be

a more accurate expression of the comparative values of varieties than the crude indication of size usually employed.

Quality is expressed upon the scale 1 to 10, the latter, in all cases, being the maximum.

The several classes or species of fruits are considered, as nearly as practicable, in the order of their ripening.

STRAWBERRIES.—(*Fragaria.*)

The station grounds are now so fully occupied by tree fruit that unavoidably the last two year's plantings of strawberries have been alternated with rows of trees; obviously greatly to the detriment of the former, and this, coupled with the effects of the drouths of the two previous seasons, has conspired to render a comparison of results in the case of many, if not most, varieties, far from satisfactory.

Conscious, therefore, that any comparison of varieties based upon the actual products of this season would under these conditions prove more or less misleading, reports upon several varieties are deferred to await farther trial; and estimates (upon the scale of one to ten), are given in the following tabulation, with reference, as far as practicable, to imperfect stands of plants as well as to the more or less unfavorable conditions otherwise. The product of the plant planted in 1895 and that planted in 1894, are compared in the following table.

Both plats were sprayed between April 13th and 17th last, with a solution of one pound of copper sulphate in twenty-five gallons of water. After the fruit had been gathered the 1895 plat was sprayed, to prevent rust, with a solution of one pound of copper sulphate in two hundred and fifty gallons of water; and the 1894 plat was plowed under, preparatory to seeding at the proper time, with crimson clover.

So far as the strawberry plats are concerned, no insects have proved troublesome during the season.

The weather having been dry during the latter part of last season with much strong wind, many varieties of strawberries in exposed portions of the younger plat were nearly covered during August and September with drifting sand. Many, thus buried, were partially uncovered, though unavoidably more or less injured in so doing, and the whole were well mulched before the advent of winter. Many of them, however, were practically dead when uncovered at the opening of spring; among which were several entire varieties. Neither originators nor introducers of novelties usually supply adequate descriptions in submitting them for trial. Hence the station can only assume that the plants received are genuine. For this reason, and on account of variations often due to differences of climate, soil or other cause, no definite descriptions of such variable characteristics is attempted.

Weight (from which size may be inferred), is arrived at by taking the weight of a considerable number of specimens and dividing the total by the number weighed. In the case of this season's crop, however, conditions have been so unfavorable that such weights are believed to be more or less misleading, and are therefore generally omitted.

TABULATION OF STRAWBERRIES FROM PLATS PLANTED IN 1894 AND 1895.

Number.	Names.	Sex. b—bi-sexual. n—nearly. p—pistillate.	First planted.	First bloom.	First picking.	Last picking.	Productiveness. First crop—Scale (1-10).	Productiveness. Second crop—Scale (1-10).	Vigor of plant—scale (1-10)	Weight of average berry in ounces.
1	Acem	b	1895	May 4	May 27	June 16	3	----	9	1-5
2	Afton	p	1893	" 4	" 29	" 16	3	6	9	----
3	Allen	b	1895	Apr. 30	" 29	" 22	2	----	8	1/5
4	Allen 5	p	1894	May 4	June 1	" 11	1	----	10	----
5	Allen 6	p	1894	" 5	" 3	" 16	2	----	10	1/5
6	Allen 13	p	1894	" 5	" 1	" 16	1	----	10	1/5
7	Aroma	b	1894	" 9	" 5	" 13	1	5	9	----
8	Auburn	p	1892	" 9	" 3	" 19	2	3	8	----
9	B·nquet	p	1894	" 4	----	----	----	3	6	----
10	Barton	p	1891	" 6	----	----	----	3	6	----
11	Beauty	b	1892	----	----	----	----	3	----	----
12	Belt 3	b	1895	May 4	June 3	June 23	3	3	9	----
13	Beverly	b	1892	" 5	" 1	" 16	2	2	9	----
14	Bickle	p	1894	" 5	May 29	" 20	3	3	6	----
15	Boynton	p	1894	" 5	" 30	" 18	2	2	10	----
16	Brandywine	b	1893	" 7	June 3	" 23	2	3	10	----
17	Brunette	b	1893	" 8	----	----	----	1	9	----
18	California	b	1891	----	----	----	----	2	----	----
19	Cameron 2	b	1894	May 6	----	----	----	2	2	----
20	Cameron 6	n p	1894	----	----	----	----	2	2	----
21	Cameron 13	p	1894	May 7	----	----	----	5	1	----
22	Cameronian	p	1893	----	----	----	----	3	----	----
23	Carrie	p	1895	May 6	June 5	June 27	2	----	6	----
24	Chairs	p	1893	" 5	" 5	" 13	----	7	7	----
25	Chairs E. S. B.	b ?	1893	" 13	----	----	1	----	1	----
26	Champion (Eng.)	b	1895	" 10	June 5	June 16	3	----	8	1/5
27	Charlie	p	1894	" 8	----	----	----	10	8	----
28	Cheyenne	p	1894	" 5	June 5	June 23	4	5	9	----
29	Clark	b	1892	" 4	" 1	" 20	1	2	3	----
30	Cleveland	p	1888	" 6	" 1	" 20	2	1	9	----
31	Columbia	b	1894	" 3	" 1	" 18	2	2	9	----
32	Concensus	p	1893	" 11	" 5	" 23	3	2	10	----
33	Copernicus	p	1893	" 11	----	----	----	2	9	----
34	Crescent	p	1888	" 6	May 29	June 20	1	2	8	----
35	Cruse	b	1894	" 7	----	----	----	4	9	----
36	Curtis 15	b	1892	" 6	----	----	----	3	6	----
37	Curtis 159	p	1892	" 12	----	----	----	3	6	----
38	Cyclone	b	1894	----	----	----	----	2	----	----
39	Daisy	p	1890	May 7	----	----	----	1	1	----
40	Dan Bisel	b	1894	" 4	June 1	June 23	8	8	10	1-5
41	Dayton	b	1892	" 6	May 29	" 20	4	1	10	----
42	Earliest	b	1895	" 4	" 27	" 16	4	----	10	1/5
43	Early Jack	b	1894	" 4	June 1	" 20	6	8	10	----
44	Edgar	p	1890	" 6	" 5	" 20	2	3	9	----
45	Edith	p	1894	" 13	----	----	----	2	5	----
46	Edwards	b	1894	" 6	June 1	June 23	1	3	6	----
47	Edwards (Fav.)	b	1894	" 8	" 5	" 22	3	3	6	----
48	Eleanor	b	1895	" 7	" 3	" 20	1	----	7	----
49	Enhance	b	1890	" 8	----	----	----	5	2	----
50	Epping	p	1894	----	----	----	----	4	2	----
51	Equinox	b	1894	May 8	----	----	----	2	----	----
52	Eureka	p	1888	----	----	----	----	3	----	----
53	Fairmont	b	1891	May 8	----	----	----	4	4	----
54	Feicht 2	b	1894	" 4	May 29	June 16	3	4	9	----
55	Feicht 3	p	1894	" 5	June 5	" 20	4	5	9	----

TABULATION OF STRAWBERRIES.—Continued.

Number.	Name.	Sex. b—bi-sexual. n—nearly. p—pistillate.	First planted.	First bloom.	First picking.	Last picking.	Productiveness. First crop—scale (1-10).	Second crop—scale (1-10).	Vigor of plant—scale (1-10.)	Weight of average berry (scale (1-10).
56	Fir	b	1894	May 8	June 5	June 20	2	2	7	----
57	Florence	b	1888	----	----	----	----	2	----	----
58	Gardner	b	1895	May 5	June 8	June 20	2	----	8	----
59	Gipsy	p	1894	May 6	May 29	" 30	4	6	10	----
60	Glenfield	b	1894	" 4	" 29	" 18	1	2	6	----
61	Greenville	p	1891	" 8	----	----	----	8	9	----
62	Harmon	b	1894	" 6	----	----	----	8	10	----
63	Hattie	p	1892	" 8	June 5	June 27	2	5	8	----
64	Haverland	p	1887	" 27	" 8	" 16	1	5	9	----
65	Hermit	b	1892	" 6	May 29	" 22	2	3	8	----
66	Holland	p	1895	" 8	June 8	" 20	2	----	9	----
67	Holyoke	b	1891	----	----	----	----	8	----	----
68	Hugo	b	1891	May 6	----	----	----	2	1	----
69	Huntsman	b	1892	" 8	----	----	----	2	2	----
70	Hyslop	b	1892	Apr. 30	May 27	June 11	3	2	9	----
71	Iowa	b	1892	May 7	----	----	----	1	2	----
72	Irene	----	1893	" 4	June 1	June 20	3	----	9	1/4
73	J. S. 4	p	1894	" 5	" 8	" 20	4	6	10	----
74	J. S. 6	p	1894	" 8	" 11	" 22	2	2	2	----
75	Kansas	b	1894	" 7	" 18	" 22	3	6	10	----
76	Katie	b	1892	" 7	" 8	" 20	1	2	9	----
77	Klickita	p	1894	" 12	" 13	" 22	1	1	9	----
78	Kossuth	b	1894	" 5	May 27	" 11	1	4	8	----
79	Kyle 1	----	1895	----	June 8	" 22	2	----	9	1/6
80	La Crosse	n p	1893	May 11	" 8	" 22	1	2	6	----
81	Leader	b	1892	" 5	----	----	----	8	2	----
82	Lehigh	p	1891	" 6	May 27	June 22	2	8	7	----
83	Leroy	p	1893	" 5	" 27	" 20	7	2	8	----
84	Leviathan	b	1892	" 9	June 3	" 20	8	2	6	----
85	Lincoln	p	1892	" 5	May 29	" 22	5	5	9	----
86	Little 26	b	1894	" 7	June 3	" 22	2	8	9	1/6
87	Little 42	b	1894	" 8	June 1	" 22	2	4	8	----
88	Longfield	p	1894	" 6	May 29	" 22	4	4	8	1-6
89	Lovett	b	1891	" 6	" 29	" 22	4	8	9	----
90	Lower	b	1894	" 12	June 11	" 22	1	1	6	----
91	Magnate	p	1894	" 5	" 8	" 18	2	1	8	----
92	Marshall	b	1894	" 9	" 3	" 20	1	2	8	1/6
93	Mary	p	1894	" 12	" 18	" 18	1	----	9	1/6
94	Maxwell	b	1894	" 8	" 8	" 22	1	3	7	----
95	Meeks	b	1894	" 4	May 29	" 5	1	2	9	----
96	Miller	b	1890	" 6	June 8	" 20	1	2	9	----
97	Monroe	b	1891	----	----	----	----	2	----	----
98	Murray	p	1895	May 5	May 29	June 16	8	----	6	1/4
99	Muskingum	b	1892	" 8	June 1	" 20	6	4	9	----
100	Mystic	b	1892	" 9	" 5	" 20	1	----	6	----
101	No Name	b	1894	" 7	" 1	" 20	6	8	9	----
102	No 31	b	1893	" 8	----	----	2	----	8	----
103	Odessa	p	1894	" 6	----	----	1	----	9	----
104	Ohio Centennial	b	1893	" 7	June 5	June 20	1	4	9	----
105	Ona	p	1894	" 7	" 8	" 20	2	2	10	----
106	Orange Co.	p	1893	" 7	" 1	" 22	4	----	7	1/6
107	Oregon 278	b	1894	" 11	----	----	----	3	6	----
108	Orono	p	1895	" 5	June 11	June 16	1	----	8	1/6
109	Ostego	p	1894	" 13	----	----	----	2	9	----
110	Pacific	p	1890	" 4	June 1	June 20	3	2	8	----

TABULATION OF STRAWBERRIES.—CONCLUDED.

Number.	Name.	Sex. b—bi-sexual. n—nearly. p—pistillate.	First planted.	First bloom.	First picking.	Last picking.	Productiveness. First crop—Scale (1-10).	Productiveness. Second crop—Scale (1-10).	Vigor of plant—Scale (1-10).	Weight of average berry in ounces.
111	Paris King	b	1895	May 8	June 3	June 16	2	---	9	⅛
112	Parker Earle	b	1889	" 7	" 5	" 20	5	2	7	---
113	Pawnee	p	1894	" 6	" 3	" 20	2	4	7	---
114	Phillip	b	1894	" 6	" 3	" 18	2	3	10	---
115	Price	b	1892	" 9	---	---	---	2	10	---
116	Primate	b	1894	" 6	June 1	June 20	3	4	6	---
117	Princess	p	1892	" 9	" 3	" 22	2	2	5	---
118	Princeton	b	1894	" 5	" 5	" 22	5	6	9	---
119	Puritan	n p	1887	---	---	---	---	1	---	---
120	Richmond	b	1894	May 7	June 5	June 22	2	7	8	---
121	Riehl 6	b	1893	" 4	" 1	" 22	5	3	8	---
122	Rio	b	1894	" 5	" 1	" 22	4	3	7	---
123	Robinson	b	1894	" 5	" 1	" 22	6	2	6	---
124	Sadie	p	1890	---	---	---	---	7	---	---
125	Sandoval	b	1890	May 5	June 3	June 22	3	2	6	---
126	Saunders	b	1889	" 11	" 1	" 22	6	6	10	---
127	Scarlet Ball	p	1892	" 7	" 7	" 22	6	8	7	---
128	Sharpless?	b	1880	" 9	" 9	" 22	4	---	9	---
129	Shawnee	n p	1894	" 7	" 3	" 22	7	5	10	---
130	Sherman	b	1895	" 7	" 5	" 22	2	---	6	1-5
131	Shuckless	b	1894	" 5	" 1	" 22	3	3	9	---
132	Smalley	p	1894	" 8	" 3	" 22	5	3	9	---
133	Smeltzer	b	1894	" 5	" 1	" 16	1	2	9	---
134	Smith	b	1894	" 5	" 1	" 16	4	3	10	---
135	Snowball	b	1895	" 5	" 3	" 22	2	---	9	⅛
136	Southard	b	1892	" 5	" 1	" 22	3	4	8	---
137	Speece	p	1890	" 9	" 3	" 22	4	2	6	---
138	Splendid	b	1893	" 4	" 1	" 20	5	4	8	---
139	Springdale	b	1894	" 8	" 5	" 20	2	3	7	---
140	Stahelin	p	1894	" 6	" 3	" 22	5	5	9	---
141	Standard	b	1894	" 4	" 3	" 20	4	3	8	---
142	Staples	b	1895	" 5	May 27	" 16	5	---	6	⅛
143	Stewart	b	1895	" 4	" 27	" 16	3	---	9	1-5
144	Sunnyside	p	1895	" 8	June 3	" 22	4	---	9	⅛
145	Surprise	b	1892	" 6	" 3	" 22	3	2	6	---
146	Swindle	p	1892	" 6	" 3	" 22	6	3	7	---
147	Tennessee	b	1894	" 7	" 3	" 22	4	6	9	---
148	Thompson 40	p	1894	" 3	" 5	" 22	3	2	9	---
149	Thompson 66	p	1894	" 8	" 5	" 22	2	6	9	---
150	Timbrell	p	1892	" 12	" 16	" 22	1	3	6	---
151	Tom Walker	p	1894	" 12	" 5	" 22	1	2	8	---
152	Tonga	p	1894	" 6	" 8	" 22	3	3	9	---
153	Topeka	b	1894	" 7	" 5	" 27	3	3	9	---
154	Van Deman	b	1894	" 4	" 3	" 11	2	---	8	---
155	Warfield	p	1890	" 5	" 1	" 18	7	7	9	---
156	Weston	p	1892	" 6	" 3	" 20	3	3	6	---
157	Williams	b	1892	" 11	" 3	" 22	3	3	9	---
158	Wilson	b	1876	" 5	" 3	" 22	3	2	9	---
159	Wood (Beder)	b	1890	Apr. 30	" 1	" 22	7	3	10	---
160	Woolverton	b	1891	May 11	" 3	" 22	5	9	9	---
161	Wyatt	b	1895	" 7	" 8	" 22	2	---	6	1-5

As will be obvious from the foregoing table, owing doubtless to the peculiarities of the season, combined with unfavorable environment otherwise, few if any of the varieties under trial can be assumed to have shown their inherent capabilities. Indeed, while thirty-six, of the tabulated varieties have reached the assumed medium in one or the other of the plats compared, only nine of these have reached such medium in both plats; while a single one only—the Charlie—has reached the maximum in either plat.

Under these circumstances descriptions would doubtless be liable to prove misleading. It is therefore thought better to omit them this year.

RASPBERRIES.—(*Rubus*).

The old plat of small fruits was fruited, this year, for the last time, and has now been removed.

The new plat, planted in the spring of last year, owing doubtless in a large measure to the severe drouths of last season and that of the past spring, even next year, will scarcely yet be in condition to fully express the relative characteristics of varieties.

The difficulty of making early and trustworthy comparisons, in cases of newly introduced varieties, is frequently increased by the custom of many introducers of supplying less than a stand (often only one, two or three plants), of varieties for trial, necessitating more or less enfeeblement of those received, as the result of propagation for the completion of the stand of ten plants from which, in all cases, comparisons are drawn.

Between April 11th and 13th both the old and the new plantations of raspberries (including blackberries also), were sprayed with a solution of a pound of copper sulphate in twenty-five gallons of water.

As a preventive of anthracnose, the raspberry and blackberry plats were again sprayed, on May 16th, with Bordeaux mixture of standard strength.

On June 10th raspberries and blackberries were again sprayed for anthracnose, using a solution of three ounces of copper sulphate in fifty gallons of water. These two sprays have apparently proved quite effectual, since very little of the fungus is now (Oct.) perceptible.

Insects have not, this year, proved troublesome upon the raspberry, although occasional deposits occur of the eggs of the snowy cricket—*Œcanthus niveus*.

As in my previous report, the comparison of values is by the weight of a specimen instead of size.

Productiveness and quality are expressed upon the scale 1 to 10—the latter being the maximum.

RASPBERRIES (*Rubus*).

Number.	Name.	Species.	Planted.	First bloom.	First picking.	Last picking.	Weight of berry in ounces.	Productiveness—Scale (1-10).	Color. b—black. r—red. y—yellow.	Quality—Scale (1-10).
1	Ada	Occidentalis	1890	May 18	June 20.	July 20.	1-14	4	b	4
2	American Everbearing	Occidentalis	1893	" 13.	" 18	" 10	1-23	7	b	4
3	Brandywine	Strigosus	1888	June 2.	" 30	Aug. 1.	1-14	6	r	8
4	Cardinal	Neglectus	1890	May 10.	" 20	July 29.	1-7	7	r	5
5	Carman	Occidentalis	1890	" 12.	July 8	Aug. 8.	1-17	10	b	10
6	Caroline	Neglectus ?	1888	" 16.	June 22.	" 1	1-10	9	y	8
7	Centennial	Occidentalis	1888	" 15.	" 15	July 8.	1-10	10	b	4
8	Champlain	Idaeus ?	1896							
9	Church	Strigosus	1894	May 14.	June 20	Aug. 10.	1-14	6	r	9
10	Columbian	Neglectus ?	1896							
11	Conrath	Occidentalis	1893	May 14.	June 22	July 15	1-9	6	b	5
12	Cromwell	Occidentalis	1889	" 12.	" 16.	" 10	1-15	10	b	5
13	Cuthbert	Strigosus	1888	" 20	" 22.	" 29.	1-10	5	r	5
14	Diamond	Occidentalis	1896							
15	Doolittle	Occidentalis	1888	May 14.	June 19.	July 10.	1-10	10	b	7
16	Earhart	Occidentalis	1888	" 13	" 19	Aug. 1.	1-10	6	b	7
17	Early King	Strigosus	1894	" 19.	" 17	July 29.	1-8	8	r	9
18	Emmett		1895	" 27.	" 25.	" 29.	1-10	6	r	5
19	Eureka	Occidentalis	1895	" 12.	" 21.	" 15.	1-13	9	b	6
20	Farnsworth	Occidentalis	1891	" 16.	" 22.	" 16	1-20	7	b	4
21	Gault	Occidentalis	1896							
22	Gladstone	Strigosus	1888	May 14	June 15.	July 29.	1-16	7	r	4
23	Golden Queen	Strigosus	1888	" 14.	" 15	Aug. 1.	1-12	8	y	7
24	Green (new)	Occidentalis	1895	" 15.	" 22	" 8	1-8	4	b	4
25	Gregg	Occidentalis	1888	" 16.	" 23.	" 12	1-13	4	b	4
26	Hansell	Strigosus	1888	" 14.	" 13	" 10	1-12	10	r	5
27	Herstine	Idaeus	1888	" 10.	" 22	" 10.	1-10	4	r	10
28	Hilborn	Occidentalis	1888	" 16.	" 15.	July 15.	1-13	6	b	10
29	Idaho	Leucodermis	1890	" 16.	" 29	" 8	1-8	4	b	5
30	Indiana	Occidentalis	1888	" 13.	" 18	" 12.	1-12	9	b	5
31	Jap. Wineberry	Phoenicolasius	1892	June 7.	Aug. 7	Aug. 29.		8	r	1
32	Johnston	Occidentalis	1888	May 16.	June 23	July 15.	1-24	10	b	4
33	Kansas	Occidentalis	1892	" 14.	" 27.	" 12.	1-12	9	b	4
34	Kenyon	Strigosus	1895	" 20.	" 21	Aug. 10.	1-14	6	r	8
35	Logan (berry)		1896							
36	London	Strigosus	1895	May 21.	June 23	Aug. 1.	1-5	5	r	8
37	Lovett	Occidentalis	1891	" 14.	" 20.	July 10.	1-14	10	b	10
38	Marlboro	Str. X Idaeus	1888	" 15.	" 18	" 29	1-8	10	r	4
39	Miller	Strigosus	1895	" 22.	" 22.	Aug. 10.	1-18	5	r	8
40	Mills (15)	Occidentalis	1895	" 19.	" 23	July 12.	1-16	4	b	6
41	Muskingum	Neglectus	1893	" 20.	" 22.	" 29.	1-12	10	r	5
42	Nemaha	Occidentalis	1888	" 14.					b	
43	Ohio	Occidentalis	1888	" 18.	June 18	July 15.	1-12	10	b	6
44	Older	Occidentalis	1893	" 14.	" 23.	" 15.	1-13	6	b	5
45	Palmer	Occidentalis	1890	" 11.	" 16	" 8.	1-14	10	b	8
46	Phoenix	Strigosus ?	1896							
47	Progress	Occidentalis	1890	May 13.	June 17.	July 13	1-18	10	b	5
48	Redfield	Occidentalis	1895	" 27.	" 26	" 29	1-20	6	b	5
49	Reeder	Strigosus	1888	" 16.	" 17	Aug. 8.	1-9	5	r	9
50	Reliance	Strigosus	1888	" 21.	" 29.	" 8	1-10	6	r	4
51	Shaffer	Neglectus	1888	" 20.	" 20.	July 29.	1-10	4	r	5
52	Smith Giant	Occidentalis	1892							
53	Smith Prolific	Occidentalis	1893	May 16.	June 21	July 12	1-13	7	b	10
54	Souhegan	Occidentalis	1888	" 14.	" 17	" 8.	1-14	9	b	5
55	Superlative	Idaeus ?	1895	" 19.	" 20	Aug. 15.	1-12	5	r	4
56	Thompson	Strigosus	1890	" 18.	" 15	July 29	1-12	6	r	4
57	Thwack	Strigosus	1893	" 16.	" 20	Aug. 15.	1-14	5	r	5
58	Turner	Strigosus	1888	" 23.	" 22.	" 10.	1-21	6	r	10
59	Tyler	Occidentalis	1888	" 13.	" 17.	" 1	1-16	10	b	4
60	Winona	Occidentalis	1895	" 14.	" 18.	" 8.	1-16	9	b	8

Ada and American Everbearing blackcaps, thus far, have exhibited no especially valuable qualities. The latter here develops no everbearing tendencies.

Conrath, Cromwell, Doolittle, Souhegan and Tyler are all early, and in most respects much alike. Doolittle is variable; and, in favorable seasons, occasionally of superior size and flavor. Souhegan and Tyler, though doubtless of separate origin, are practically identical.

Earhart is thus far the only blackcap tested here that can be said to be everbearing; producing, as it does, a fall crop upon the canes of the current year's growth; which, however, are not unfrequently caught by early frost in an unripe condition. Desirable only for the home plantation.

Palmer, so far, is scarcely excelled as a profitable second early blackcap.

Gregg and Nemaha, so long the leading market blackcaps, appear to be rapidly giving place to more recent varieties.

Cuthbert is still popular for market, and Golden Queen and Reeder can be safely recommended for the home plantation.

Early King, first planted in the spring of 1894, has so far proved productive of good size and fair quality. A promising red variety.

Herstine, though needing protection in winter, is well worth a place in the home plantation.

Thwack, red, was tested here more than a dozen years since, and condemned as too low in quality. An objection which is also, to some extent, true of Marlboro. Quite recently the former is being commended as an attractive market berry.

Notices of other recently tested varieties are deferred to await experience under more favorable conditions.

BLACKBERRIES.—(*Rubus villosus*).

The former plantation of blackberries has been uprooted since gathering the current year's crop.

Both the old and the new plantations were alternated with raspberries, as a safeguard against mixing varieties by means of sprouts or suckers. The two have, for this reason, been treated alike so far as spraying is concerned; and the reader is therefore referred for this to the section on raspberries.

Anthracnose has been the only troublesome fungus during the season; but the treatment described under the head of raspberries has apparently very nearly subdued it.

A few cases of red rust were discovered, and the plants were at once dug and burned; since which no farther cases have been discovered.

Of insects, the leaf miner, *Tischeria malifoliella*, Clemens, has been increasingly prevalent. The process of gathering and burning the affected foliage has again been resorted to. Later, their work has again become apparent; and the gathering and burning process has been repeated. Results, so far, indicate that a more effective process is needful for their extermination. With the above exception, insect pests have not proved troublesome during the season. Warm weather during the early part of the season shortened the fruiting season of some varieties, limiting both size and quantity of the fruit, though timely rain somewhat revived others, continuing their season and increasing their yield of fruit.

BLACKBERRIES (*Rubus villosus*).

Number.	Name.	Planted.	First bloom.	First picking.	Last picking.	Weight of berry in ounces.	Productiveness—scale 1 to 10.	Quality—scale 1 to 10.
1	Agawam	1888	May .	July 2.	Aug. .	1-5	7	8
2	Ancient Briton	1888	" .	" 4.	" 5.	1-6	5	8
3	Austin							
4	Childs (Tree)	1888	June 1.	July 13.	Aug. 21	1-10	6	5
5	Early Harvest	1888	May 20.	June 28.	" 1.	1-9	6	5
6	Early King	1890	" 16.	" 28.	" 1.	1-9	10	7
7	Early Mammoth	1888	" 15	July 1.	" 1.	1-5	10	7
8	Eldorado	1894	" 15.	" 8.	" 4.	1-7	5	6
9	Erie	1888	" 15.	" 8.	" 7.	1-5	10	5
10	Fruitland	1893	" 22.	" 28.	" 1.	1-8	5	5
11	Kittatinny	1888	" 18.	" 8.	" 10.	1-6	10	7
12	Knox	1888	" 16.	" 7.	" 4.	1-6	8	7
13	Lawton	1888	" 16.	" 3.	" 1.	1-6	10	7
14	Lincoln	1893	" 14.	" 6.	" 1	1-9	6	5
15	Lovett (Best)	1896						
16	Maxwell	1894	May 22.	July 8.	Aug. 5.	1-12	5	6
17	Minnewaski	1888	" 18.	" 16	" 1.	1-5	10	5
18	Nevada	1888	" 18.	" 20.	" 15.	1-5	7	5
19	Ohmer	1893	" 18.	" 8.	" 1.	1-8	7	7
20	Oregon (Everbearing)	1893	June 7.	" 25.	" 21.	1-12	4	4
21	Otis	1896						
22	Piasa	1895	May 18.	July 9.	Aug. 6.	1-15	3	6
23	Reyner	1896						
24	Sanford	1894	May 15.	July 10.	Aug. 1.	1-9	10	5
25	Snyder	1888	" 13.	" 3.	" 1.	1-10	10	10
26	Taylor	1888	" 15.	" 8.	" 8.	1-11	8	10
27	Thompson	1888	" 18.	" 3.	" 18.	1-5	10	4
28	Triumph (Western)	1888	" 15.	" 7.	" 5.	1-8	10	4
29	Wallace	1888	" 14.	" 6.	" 1.	1-8	10	7
30	Wilson	1888	" 18.	" 2.	" 15.	1-4	8	4
31	Wilson, Jr.	1888	" 18.	" 2.	" 15.	1-5	6	4

NOTES ON VARIETIES.

Agawam, Knox, and Wallace are old varieties, which may be safely commended for home use, if not even for market.

Ancient Briton and Triumph (Western) are, in certain localities, commended for market. Though hardy, they are quite too small, unless with good soil, high culture and close pruning.

Austin, a new dewberry from Texas, Lovett (Best), Otis, and Reyner, are recently planted varieties not yet fruited.

Childs (Tree), though planted in 1888, has little so far to recommend it.

Early Harvest, though early and good, is rather small and lacks hardiness.

Early King and Early Mammoth are large, vigorous and productive. They are worthy of extensive trial.

Eldorado, Fruitland, Lincoln, Maxwell, Ohmer, Piasa, and Sandford, though several of them appear to be promising, are yet on probation.

Erie, Minnewaski, Nevada and Thompson, so far appear to be variable; often more or less unproductive.

Snyder and Taylor are very hardy, of fair size, productive and profitable, where hardiness is specially needful.

Wilson, and Wilson, Jr., are practically identical, very large, of low quality, and the plants tender, requiring winter protection, even at the lake shore.

SERVICE BERRY (*Amelanchier*).

This fruit, under the name of June Berry, or Shad Bush, is common in the forests of portions of Michigan, as a large shrub or small tree, frequently attaining the height of fifteen or even twenty feet. The fruit is usually sparsely produced and variable in size, but generally small and of indifferent though pleasant quality.

The varieties grown here are understood to be of western origin, and are of dwarfish habit, usually three or four feet in height, and producing abundant crops of fruit, in appearance much like the whortleberry, though by no means its equal in flavor.

These were received, the first as Dwarf June Berry, the second as Success, and the third as Mammoth. This last is slightly more vigorous than the others, and in occasional seasons perhaps a little more prolific; but the birds seem especially fond of the fruit, and are quite sure to appropriate it unless protected by netting.

CURRANTS.—*Ribes*.

A new stand of currants having been planted last year, the old plantation was uprooted, after securing the current year's crop.

March 30. Sprayed currants (in connection with gooseberries), with a solution of one pound of copper sulphate in 25 gallons of water.

April 30. Sprayed currants and gooseberries, to prevent mildew, using one pound copper sulphate in 500 gallons of water.

May 6. The currant worm, *Nematus ventricosus*, having appeared, both currants and gooseberries were sprayed with one pound of Paris green in 250 gallons of water.

May 15. To subdue the currant worm and mildew, currants and gooseberries were again sprayed, using Bordeaux mixture of standard strength, with the addition of ½ pound of Paris green to 50 gallons.

June 1. Currants and gooseberries were again sprayed, for worms and mildew, using three ounces of copper sulphate and three ounces of Paris green in 50 gallons of water.

June 10. Repeated the spray upon currants and gooseberries, for worms and mildew, using the same preparation.

June 18. Sprayed gooseberries for mildew, using three ounces of liver of sulphur, *potassium sulphide*, in ten gallons of water.

July 10. Gooseberries were sprayed for mildew, with one pound of copper sulphate in 250 gallons of water.

August 4. Sprayed currants and gooseberries for mildew, with one pound of copper sulphate in 200 gallons of water.

More or less mildew has appeared upon several varieties of gooseberries of European parentage, due, probably to too long periods between sprayings, which were, in several cases, deferred on account of the prevalence of rain or high winds.

The twig borer, *Ægeria tipuliformis*, has apparently been less prevalent than heretofore, although the extent of its depredations may become more fully manifest during next spring's pruning.

Aside from those mentioned, no other insects have proved troublesome.

The weights of single berries are given instead of size, and it will be observed that, in all cases, the denominator of the fraction expresses the number of berries in an ounce.

Productiveness and quality are expressed upon the scale of one to ten, ten being in all cases the maximum, and each variety is compared with others of the same species.

CURRANTS.—(*Ribes.*)

Number.	Name.	Species.	Planted.	Bloomed.	Ripened.	Weight of berry in ounces.	Productiveness—scale (1–10).	Quality—scale (1–10).
1	Champion	Nigrum	1889	Apr. 24	June 20	1-17	5	5
2	Cherry	Rubrum	1888	" 21	" 15	1-28	5	7
3	Crandall	Aureum	1889	" 27	" 24	1-20	10	1
4	English	Nigrum	1892	" 28	" 15	1-18	10	5
5	Fay	Rubrum	1888	" 21	" 20	1-37	10	7
6	Holland (Long Bunched)	Rubrum	1889	" 27	" 20	1-44	10	5
7	Lakewood	Rubrum	1890	" 23	" 15	1-25	7	7
8	Lee	Nigrum	1888	" 25	" 20	1-21	5	3
9	London	Rubrum	1890	" 27	" 15	1-37	10	4
10	Naples	Nigrum	1888	" 28	" 20	1-37	1	5
11	North Star	Rubrum	1890	" 21	" 15	1-45	9	7
12	Red Dutch	Rubrum	1888	" 23	" 15	1-48	10	8
13	Ruby Castle	Rubrum	1892	" 24	" 15	1-45	7	6
14	Ruby (Moore)	Rubrum	1890	" 24	" 8	1-32	10	8
15	Saunders	Nigrum	1890	" 28	" 8	1-28	5	3
16	Select (Moore)	Rubrum	1890	" 21	" 15	1-35	7	5
17	Versaillaise	Rubrum	1888	" 21	" 15	1-39	10	7
18	Victoria	Rubrum	1888	" 27	" 15	1-44	10	5
19	Wales (Prince)	Nigrum	1890	" 27	" 20	1-15	9	3
20	White Dutch	Rubrum	1888	" 23	" 15	1-44	10	10
21	White Gondoin	Rubrum	1890	" 27	" 15	1-30	10	10
22	White Grape	Rubrum	1888	" 27	" 15	1-34	10	8
23	Wilder	Rubrum	1890	" 28	" 8	1-20	10	7

NOTES ON VARIETIES.

Champion, Lee, Saunders and Wales are comparatively recent varieties of the European black currant, and the (Black) English is a much older one of that species. So far, none of these, here, have equaled the Naples, in either vigor or productiveness; neither have they excelled it in size of fruit.

Cherry, Fay, Wilder and Lakewood are quite similar in foliage and size of fruit. In productiveness they range about in the order named.

Crandall, a variety of the yellow flowering currant, betrays, in the diverse habit and productiveness of the plants, the probability, not to say certainty,

that it may have been the product, not of a single seedling, but rather of a batch of seedlings. It has been dropped from the collection here as unworthy.

Holland (Long-bunched), proves to be by far the most vigorous variety so far tested here. The bunches are long but the berries small. The size and productiveness of the plant, however, fully compensate for the lack of size of the fruit.

London (Red), though scarcely up in quality, is very vigorous and productive.

North Star is much like Holland in some respects, though scarcely as vigorous or productive so far.

Red Dutch is, even yet, scarcely excelled as a profitable market variety, with only the objection of its liability to the attacks of the twig borer, which, judging from experience here, so far, may, perhaps, be subdued by the persistent cutting and burning of the affected wood.

Ruby Castle, Ruby (Moore), and Select (Moore), appear to be desirable, if at all, rather as specialties for amateurs.

Victoria, apparently owes its popularity to a comparative exemption from the attacks of the twig borer and to the persistence of its foliage rather than to any superiority otherwise.

White Dutch and White Gondoin are much alike, and may fairly be said to have no superiors, especially so far as great beauty and high quality are concerned.

White Grape, though scarcely equal to the foregoing in quality, and notwithstanding its faulty habit of growth, is slightly larger in berry, and, possibly, somewhat more productive.

GOOSEBERRY.—(*Ribes*).

Gooseberries are grown in rows adjacent to currants, and, so far as spraying is concerned, the two have received the same treatment, for which reference is made to the section on currants.

It should be stated, however, as was remarked under the head of currants, that considerable mildew appeared upon certain varieties of gooseberries, notwithstanding the fungicide with which they were treated. This may have been due to delays in the application, on account of rains and high winds, or possibly to weather specially favorable to the growth of fungi.

The crumpling of the terminal foliage of certain varieties, believed to be due to the presence of minute aphides, has been less noticeable than in previous years.

The only other insect depredation observed has been that of the currant worm (*Nematus ventricosus*), also mentioned under the head of currants.

Necessarily, more or less small, weak plants were used in making the new plantation of gooseberries last year, and, of several scarce varieties, the stand is even yet not full. Such being the case, at least a year or two must necessarily elapse before such plants can be expected to yield competent returns for purposes of comparison.

GOOSEBERRIES.—(*Ribes.*)

Number.	Name.	Species.	Planted.	Bloomed.	Ripened.	Weight of berry in ounces.	Productiveness—scale (1 to 10.)	Quality—scale (1 to 10.)
1	Apex	Cynosbati	1893	Apr. 28	July 6	1-4	10	8
2	Auburn	Grossularia	1890	" 28	" 30	1-10	2	8
3	Bendelon	Grossularia	1894	" 30	" 30	1-4	6	8
4	Champion	Grossularia	1891	" 27	" 29	1-10	5	5
5	Chautauqua	Cynosbati	1892	" 28	" 29	1-4	7	9
6	Columbus	Grossularia	1895	" 29	...	...	...	...
7	Downing	Cynosbati	1885	" 27	July 28	1-8	7	6
8	Golden (Prolific)	Grossularia	1891	" 30	...	...	...	...
9	Houghton	Hirtellum	1888	" 27	July 30	1-13	5	10
10	Industry	Grossularia	1889	" 25	" 27	1-2	10	7
11	Keepsake	Grossularia	1894	" 28	" 30	1-6	1	9
12	Lancashire (Lad)	Grossularia	1894	" 28	" 30	1-4	2	10
13	Orange (Early)	Grossularia	1890	" 27	" 20	1-5	2	8
14	Pale Red	Hirtellum	1890	" 27	" 30	1-13	7	10
15	Pearl	Grossularia	1890	" 27	" 28	1-7	7	10
16	Red Jacket	Grossularia	1890	" 27	" 30	1-4	1	8
17	Smith	Cynosbati	1888	" 27	" 26	1-10	6	10
18	Strubler	Cynosbati	1892	" 28	" 27	1-5	1	8
19	Tree	Cynosbati	1893	" 28	" 6	1-14	1	5
20	Triumph	Grossularia	1890	" 25	" 27	1-4	10	7

Apex, having been transplanted last year, has not yet properly developed its vigor. The plant is much like the European; although it is understood to be a seedling of the indigenous Oregon species.

Auburn, Bendelon, Columbus, Golden (Prolific), Keepsake, Lancashire (Lad) and Orange (Early) are all either European varieties, or American seedlings of European parentage, not yet sufficiently tested at this station. If exempt from mildew in this climate, it will doubtless be under efficient treatment with fungicides.

Champion, Industry, Pearl and Triumph have, for a year or two, with free use of fungicides, proved fairly vigorous and productive. They appear to be worthy of trial; but only by those who will give them efficient treatment.

Chautauqua and Red Jacket are highly commended as vigorous and productive. Both are comparatively new here. The latter is very vigorous; but their productiveness is yet to be developed in this locality.

Downing, though not of high quality, is popular as a market variety. Smith would doubtless stand still higher for such purpose, but for lack of vigor.

Houghton and Pale Red are practically identical; of good quality, and very hardy and productive, but too small.

Strubler and Tree are native western seedlings, healthy and vigorous; productiveness yet to be determined; fruit small.

CHERRIES.—(*Prunus*).

Most varieties of cherries have borne rather lightly this season. This is especially true of those received as North German or Russian varieties; while the Duke and Mazzard or sweet varieties are yet scarcely old enough to be expected to fruit heavily.

The trees were yet dormant, on April 14, when they, in common with the entire plantation, received the spray of strong solution of copper sulphate.

Cherries have been exempt from the attacks of fungi; so that no farther applications of fungicides have proved needful.

June 11. The slug, *Eriocampa cerasi*, having made its appearance; the trees were treated with a spray consisting of a tablespoonful of buhach, in a gallon of water, which proved effective for the time. A new colony appearing, another spray was applied on the 15th to the 20th, consisting of a strong decoction of tobacco stems in water, which proved thoroughly effective.

The slug proving unusually persistent, the tobacco decoction was again applied on June 20; and, for yet another visitation on August 21.

Except as already specified, no insect attacks have been observed. The curculio which frequently visits the fruit, seems to have confined its depredations to the plums and early peaches.

Estimates of productiveness and quality, as given in the following table, apply strictly to the crop of the current year.

CHERRIES (*Prunus*).

Number.	Name.	Species.	Planted.	Bloomed.	Ripened.	Weight of berry in ounces.	Productiveness—scale 1 to 10.	Quality—scale 1 to 10.
1	Abbess	Morello	1888	April 27.	June 15.	1-8	4	5
2	Angouleme	Morello	1888	" 27	" 27.	1-7	1	8
3	Badacsonyi	Avium	1894	" 27.				
4	Baendor	Morello	1892	" 28	June 8.	1-8	2	5
5	Baltavari	Avium	1894					
6	Bessarabian	Morello	1888	April 27	" 17.	1-5	3	6
7	Brusseler Braune	Morello	1889	" 28	July 2.	1-4	5	3
8	Carnation	Duke	1891	" 27	June 8.	1-6	7	7
9	Centennial	Avium	1898	" 29.				
10	Choisy	Duke	1888	" 27.	June 6.	1-7	1	9
11	Cleveland	Avium	1888	" 24	" 5.	1-6	7	8
12	Coe (Trans.)	Avium	1888	" 23	May 30.	1-5	3	7
13	Dwarf Rocky Mountain		1894	May 4	July 20.			
14	Dyehouse	Morello	1891	April 23.	June 2.	1-6	10	5
15	Eagle (Black)	Avium	1888	" 24	" 8.	1-6	6	5
16	Early Purple	Avium	1893	" 20	" 1.		7	
17	Elton	Avium	1892	" 23	" 6.	1-5	5	5
18	Esperen	Morello	1892	" 25	" 6.	1-7	8	6
19	Eugenie	Duke	1888	" 24	" 1.	1-7	3	9
20	Everbearing	Morello	1892	" 27.	" 8.	1-6	4	8
21	Florence	Avium	1892	" 24.	" 17.	1-14	2	6
22	Frauendorfer Weichsel	Morello	1888	" 25	" 17	1-5	4	6
23	Galopin	Morello	1891	" 25	" 15	1-5	1	7
24	George Glass	Morello	1888	" 24.	" 18.	1-5	2	4
25	German (Kraus)	Avium	1894					
26	Griotte du Nord	Morello	1888	April 27.	July 4.	1-6	2	6
27	Hoke	Avium	1896					
28	Hortense	Duke	1888	April 27.	June 8.	1-7	9	
29	Ida	Avium	1898	" 25.				
30	King Amarelle	Morello	1891	" 26.	June 4.	1-7	7	5
31	Knight Early	Avium	1891	" 25.	" 8.	1-7	4	10
32	La Maurie	Avium	1893					
33	Lancaster		1894					
34	Late Duke	Duke	1890	April 28.	June 4.	1-6	3	6
35	Lithauer Weichsel	Morello	1893	" 27.	" 17.	1-12	8	4
36	Luce (Gov.)		1896					
37	Lutovka	Morello	1888	April 23.	" 26.	1-6	3	7
38	Magnifique	Duke	1888	" 29.	July 4.	1-5	3	9
39	Mahaleb	Mahaleb	1893	" 30.	" 21.		2	
40	Mary (Kirtland)	Avium	1891	" 25.	June 3.	1-7	9	8
41	Mastodon (Black)	Avium	1898	" 27.				
42	May Duke	Duke	1888	" 24	May 30.	1-6	3	8
43	Mesel	Avium	1891	" 23	June 5.	1-5	6	8
44	Minnesota (Ostheim)	Morello	1892	" 27	" 15.	1-7	4	7
45	Modnyansky	Avium	1894	" 27.				
46	Montmorency	Morello	1888	" 27.	May 2.	1-2	10	4
47	Montmorency, Ordinaire	Morello	1891	" 27.	" 10	1-6	9	5
48	Montreuil	Duke	1890	" 19.	" 2.	1-4	10	6
49	Napoleon	Avium	1893	" 23.	" 18.	1-8	8	4
50	Northwest	Morello	1893	" 20.	" 23.	1-7	10	6
51	Ohio (Beauty)	Avium	1891	" 26.	" 2.	1-6	6	6
52	Olivet	Duke	1890	" 27	" 8.	1-5	1	4
53	Orel 25	Morello	1893	" 23.				
54	Orel 27	Morello	1893	" 20.				
55	Ostheim	Morello	1891	" 27.	May 15.	1-16	3	4
56	Ostheimer	Morello	1893	" 20.	" 25.	1-9	7	4
57	Philippe (Louis)	Morello	1888	" 24.	" 6.	1-7	6	8
58	Plymouth Rock		1896					
59	Purity	Avium	1898					
60	Richmond	Morello	1893	April 24.	May 3.	1-7	7	4

CHERRIES (*Prunus*).—CONCLUDED.

Number.	Name.	Species.	Planted.	Bloomed.	Ripened.	Weight of berry in ounces.	Productiveness—scale 1 to 10.	Quality—scale 1 to 10.
61	Rockport	Avium	1891	April 24.	May 2.	1-6	9	4
62	Royal Duke	Duke	1891	" 25.	" 8.	1-4	4	8
63	Rupp		1894					
64	Schmidt	Avium	1894					
65	Sebril		1896					
66	Sklanka	Morello	1888	April 27.	May 6.	1-8	9	4
67	Spanish (Yellow)	Avium	1891	" 24.	" 13.	1-4	4	10
68	Spate Amarelle	Morello	1888	" 28.	" 20.	1-6	3	6
69	Strauss Weichsel	Morello	1888	" 27.	" 6.	1-9	3	5
70	Suda	Morello	1893	" 29.	" 25.	1-8	10	8
71	Tartarian (Black)	Avium	1888	" 27.	" 6.	1-6	1	6
72	Ulatis (Cal. Adv.)	Avium	1893	" 27.				
73	White (Bigarreau)	Avium	1896					
74	Weir	Morello	1893	April 27.	June 6.	1-6	3	8
75	Windsor	Avium	1891	" 21.	" 8.	1-5	9	8
76	Wood (Gov.)	Avium	1891	" 24.	" 2.	1-6	9	6
77	Wragg	Morello	1893	" 26.	" 23.	1-8	9	4
78	Youncken (Golden)		1896					

NOTES ON VARIETIES.

A few notices of the species, origin, etc., also of the sources whence received are appended.

Abbess, received from the Russian importation of Prof. J. L. Budd, sadly lacks vigor, and is, so far, only moderately productive.

Angouleme, from the same source, is unusually vigorous, but so far sadly deficient in productiveness.

Badacconyi, Baltavati and Modnyansky belong to the sweet or Mazzard class of cherries, and are very vigorous, with promise of early fruitfulness. They come from southeastern Europe, as an importation through the National Division of Pomology.

Baender, Esperen, Everbearing, Galopin, King Amarelle, Lithauer Weichsel, Minnesota (Ostheim), Northwest, Orel 25, Orel 27, Ostheim. Ostheimer, Suda, Weir and Wragg come from unknown sources, through the Michigan Agricultural College. They are all, or nearly all, of the Morello type. Several of them promise early and abundant productiveness, but, so far, there is much apparent similarity among very many of them.

Bessarabian, Brusseler Braune, Frauendorfer Weichsel, George Glass, Griotte du Nord, Lutovka, Sklanka, Spate Amarelle and Strauss Weichsel are from the Budd importation. All are vigorous, fairly productive, and (with the single exception of Sklanka), quite acid, and ripen late. They are especially adapted to culinary purposes.

Carnation, Late Duke and Royal Duke are old varieties of the Duke class. They are apparently too persistently unproductive to ever become popular.

Centennial, La Maurie, Mastodon (Black), and Ulatis (California Advance), are understood to be California seedlings. Little is yet known of them at the east.

Choisy is one of the most beautiful and excellent of cherries, but only moderately productive. It is of the Duke class.

Cleveland, Mary (Kirtland), Ohio (Beauty), Purity, Rockport and Wood (Gov.), are Ohio seedlings, originated by the late Dr. Kirtland, of Cleveland. Several of them are more or less popular as market varieties.

Coe (Transparent), has long been recognized as one of the most beautiful and excellent of sweet cherries.

Dwarf Rocky Mountain is a recent introduction from the "wild and woolly west." If the plants on trial here correctly represent the variety, it is utterly worthless for any purpose.

Dyehouse is a very early and productive variety of the Morello class. The tree is a very slender, spreading grower, and the fruit is rather small

Eagle (Black), Early Purple, Elton, Florence, Knight, Early Mezel, Napoleon, Spanish (Yellow) and Tartarian (Black), are all Mazzards, of European origin, but have long since acquired more or less popularity in this country.

Eugenie, Hortense, Magnifique, May Duke, Montrueil and Olivet are of the Duke class, imported from Europe. Several of them have long since become highly popular in this country.

German (Kraus), is a variety of the Mazzard class, received for trial from the State of New York.

Ida and Lancaster are Dukes, both of comparatively recent origin, in the State of Pennsylvania.

Hoke, Luce (Gov.), Plymouth Rock, Rupp and Sebril were received, last spring, from various sources. They require yet another season's growth to indicate even the species to which they belong.

Mahaleb, the European Bird Cherry, is rarely used otherwise than for stocks.

Montmorency and Montmorency Ordinaire are of the Morello type.

Montmorency Large, as received here, proved incorrect. The one named above as Montmorency may prove to be the Large.

Phillippe (Louis) is an excellent, large Morello, and the tree vigorous. but persistently unproductive.

Richmond is too well known as a leading market Morello to require further description.

Schmidt and White (Bigarreau) were received in cion from the National Division of Pomology, in 1895. They are vigorous growers of the Mazzard class.

Windsor is a recent seedling of the Mazzard type, originating at Windsor, Ont. (opposite Detroit). Season late. It is attracting much attention.

PEACHES.—(*Prunus*).

With peaches, as with other portions of the plantation, the needful pruning was done during intervals of mild weather, in February and March.

In common with the entire plantation, they were treated with a spray of strong copper sulphate (one pound in 25 gallons of water), on April 14 to 17, while growth was yet dormant.

This early treatment, so far as the peach was concerned, was mainly intended to act as a preventive of leaf curl, *Taphrina deformans*. Owing, doubtless, to the peculiarity of the season, this precautionary treatment was apparently unnecessary, since, without regard to spraying, the entire locality has been partially if not wholly exempt from this malady, this season.

In the absence of other attacks of fungi, no other applications of fungicides have been found necessary.

May 5, commenced examining peach trees to destroy such borers, *Ægeria exitiosa*, as had escaped detection during the examinations of last September. Finished such examination on the 12th, finding an occasional larva.

May 14, commenced jarring trees for curculio. Its depredations upon the peach were very slight; and, as usual, mainly confined to the early and comparatively smooth skinned varieties, while, even upon these, so few insects were caught that examinations were soon abandoned, so far as the peach was concerned, and, thereafter, the jarrings were confined to the plum.

Experience here quite clearly indicates the wisdom of planting plums and peaches adjacent, and using the former as a curculio trap.

The Rose Chafer, *Macrodactylus subspinosus* has been less troublesome than heretofore, only a very few having been discovered; an occasional one only upon the peach.

Within the last three or four years a new insect enemy has appeared in the peach orchards of this vicinity, attacking the trunks and larger branches of bearing trees. The eggs are deposited upon the bark and, when hatched, the larva pierces the wood, making channels through and through it, which, outwardly, appear as if occasioned by the firing of a charge of small shot, with very serious and ultimately fatal effect upon the vigor and health of the trees attacked. As soon as discovered, last year, a coating of soap, lime and a little carbolic acid was applied to the trunks and larger branches to prevent, as far as possible, the depositing of the eggs. The above mixture was again applied on May 20, 1896. A considerable number of the older and more enfeebled trees have already been dug and burned.

In this immediate vicinity the entire spring passed without adequate rainfall, and although there were a few slight showers during the early summer, no copious rains occurred here prior to the middle of July. The village water works became available on July 7, prior to which date much expense was necessarily incurred in hauling water from Lake Michigan, for use upon various crops including newly planted trees and others heavily laden with fruit. To derive full benefit from access to the village water mains some adequate arrangement for economical distribution is yet needed.

Most varieties of fruits sent to this station for trial come without history, description, or in fact any clue to aid in determining their genuineness. Cases indeed occasionally occur in which two trees, received from the same source, under the same name, prove to be of distinct varieties with no apparent means of determining which was the variety really intended.

In such cases a concise description of the variety intended should accompany the trees.

Productiveness and quality, as given in the following table, have reference strictly to the crop of the current year.

PEACHES.—(*Prunus.*)

Number.	Name.	Planted.	Bloomed.	Flowers—l, large; s, small.	Glands—g, globose; r, reniform; s, serrate.	Ripened.	Adhesion—c, cling; f, free; s, semi cling.	Weight of specimen in ounces.	Productiveness—scale (1-10).	Quality—scale (1-10).
1	Adrian	1892	Apr. 27	s	g	Sept. 15	f	4¾	4	6-7
2	Alberge	1893	" 27	s	r	Aug. 13	f	2½	5	6-7
3	Albright	1890	" 27	s	g	Sept. 11	f	4½	4	5-6
4	Alexander	1892	" 7	l	g	July 22	s	5¾	8	5
5	Allen	1890	" 27	s	r	Sept. 21	f	4½	10	5
6	Alpha	1890	" 27	s	r	Aug. 17	c	5¾	2	4
7	Amelia	1890	" 28	l	r	" 13	f	5	9	6-7
8	Amsden	1890	" 27	s	g	July 7	s	4	10	5
9	Andrews	1890	" 27	s	r	Sept. 10	f	5	3	5
10	Arctic	1894	" 25	l	r	" 24	s	3	1	3
11	Barber	1893	" 27	l	r	" 4	f	6¾	7	7
12	Beers (Smock)	1890	" 27	s	r	" 18	f	4½	8	5
13	Bell (Fav.)	1890	" 27	s	g	Aug. 31	s	5	7	4-5
14	Bequett (free)	1890	" 25	s	r	" 24	f	6½	10	5
15	Berenice	1894	" 27	?	r	Sept. 11	f	5	2	4
16	Bickell	1890	" 27	s	r	Sept. 28	f	3¾	3	1-3
17	Bishop	1890	" 27	s	g	Aug. 4	s	5	7	3
18	Blood Leaf	1892	" 25	l	r	Sept. 22	c	2¾	9	1
19	Bokhara	1896	....	....	....	....	....	....	....	....
20	Bonanza	1890	Apr. 27	s	r	Sept. 28	f	3½	10	1-2
21	Boyle	1890	" 27	s	g	Aug. 17	f	4	6	7
22	Brandywine	1890	" 25	s	g	Sept. 14	f	6	6	5
23	Brett	1890	" 28	s	r	Oct. 13	c	3½	9	3
24	Brigdon	1890	" 27	s	g	Aug. 20	f	3¾	6	7-8
25	Briggs	1890	" 27	s	g	" 15	f	5¾	5	8
26	Bronson	1890	" 27	s	r	Sept. 1	f	3¾	8	6-7
27	Brown	1893	" 31	l	r	Aug. 10	f	4	8	4
28	Burke	1892	" 27	l	r	" 31	s	8	4	5
29	California	1895	....	....	....	....	r	....	....	....
30	Canada	1893	Apr. 25	l	g	July 15	c	4	10	4
31	Capital	1896	....	....	....	....	....	....	....	....
32	C—— Cling	1894	....	....	r	....	....	....	....	....
33	Chairs	1890	Apr. 27	s	r	Sept. 15	f	4	8	3-4
34	Champion (Ohio)	1892	" 25	l	s	July 9	c	3	7	10
35	Champion (Mich.)	1890	" 25	s	g	Aug. 14	f	8	7	4
36	Chili	1888	" 27	l	r	Sept. 4	f	3½	9	5
37	Chili 2	1888	" 25	s	r	" 11	f	5	10	6-7
38	Chili 3	1888	" 27	s	r	" 7	f	5	7	8
39	Chinese (Cling)	1890	" 25	l	r	Apr. 24	c	3¾	2	6-7
40	Chinese 11741	1896	....	....	....	....	....	....	....	....
41	Cleffey (Allen)	189[illegible]	Apr. 27	s	r	Aug. 31	f	5½	6	5
42	Clifton (Cling)	1896	....	....	....	....	....	....	....	....
43	Columbia	1890	Apr. 27	l	r	Sept. 17	f	5	10	1-2
44	Conkling	1890	" 25	s	r	Aug. 24	f	4¾	7	4
45	Connecticut	1896	....	....	....	....	....	....	....	....
46	Connett	1894	Apr. 27	?	r	Aug. 15	f	5¾	2	7-8
47	Coolidge (Mam.)	1892	" 25	s	g	Sept. 4	f	5	7	7
48	Corner	1890	" 27	s	r	Aug. 31	f	5	4	5-6
49	Crosby	1892	" 27	s	r	Sept. 15	f	4	8	7
50	Crothers	1890	" 25	s	g	" 10	f	5	9	6-7
51	Dennis	1890	" 25	l	g	Aug. 24	f	3½	10	4-5
52	Diamond	1892	" 27	s	g	Sept. 15	s	6	5	5
53	Druid Hill	1890	" 27	s	g	" 16	f	5	8	8
54	Dumont	1894	" 27	s	r	Aug. 25	f	4	2	3-4
55	Dunlap	1893	" 27	s	g	" 24	f	4¾	5	7-8

PEACHES.—Continued.

Number.	Name.	Planted.	Bloomed.	Flowers—l, large; s, small.	Glands—g, globose; r, reniform; s, serrate.	Ripened.	Adhesion—c, cling; f, free; s, semi cling.	Weight of specimen in ounces.	Productiveness—scale (1-10).	Quality—scale (1-10)
56	Dwarf Cuba	1892	Apr. 27	s	r	Sept. 19.	c	5	1	1-2
57	Early Barnard	1888	" 27	s	r	Aug. 20.	f	3¾	9	5
58	Early Crawford	1888	" 27	s	g	" 8.	f	5	8	8
59	Early Crawford 1	1888	" 27	s	g	" 12.	f	4½	10	7-8
60	Early Crawford 3	1888	" 27	s	g	" 19.	f	4½	9	7
61	Early Michigan 15	1894	" 25	l	g	" 13	f	3	6	9-10
62	Early Michigan 16	1892	" 25	l	r	" 8.	f	4	10	9-10
63	Early Silver	1888	" 27	l	r	" 21.	f	2¾	10	5
64	Ede	1890	" 25	s	g	" 28.	f	5	7	6
65	Elberta	1890	" 27	s	r	" 31.	f	4	8	5-6
66	Eldred (Cling)	1890	" 27	s	g	" 17	c	6	----	----
67	Ellison	1889	" 27	s	r	Sept. 24.	f	3	7	4-5
68	Engle (Mam.)	1892	" 25	s	g	Aug. 20.	f	5	7	9-10
69	Ford New	1894	" 27	s	g	" 31.	f	6	8	6
70	Ford Red	1894	" 27	s	g	--------	-------	-----	----	----
71	Ford 1	1894	" 27	s	r	Aug. 10.	f	6¾	4	6-7
72	Ford 2	1894	" 27	s	g	Sept. 20.	f	6	1	5-6
73	Ford 3	1894	" 28	s	r	--------	-------	-----	1	
74	Foster	1885	" 27	s	g	Aug. 10	f	5¾	8	7-8
75	Fox	1890	" 27	s	g	Sept. 11.	f	3¾	7	6
76	Geary (Holdon)	1890	" 27	s	r	" 17.	f	6	10	6
77	Gem (Cling)	1890	" 27	s	r	" 8.	c	4	7	5
78	Globe	1888	" 27	s	g	Aug. 13.	f	5¾	5	5
79	Gold Drop	1890	" 25	l	r	Sept. 8.	f	2½	7	6-7
80	Grant (Gen.)	1890	" 27	s	r	" 14.	c	4¼	5	3-4
81	Great Western	1892	" 27	s	r	Aug. 2.	c	4¾	4	4
82	Greensboro	1896	------	----	------	------	------	-----	-----	-----
83	Gudgeon	1890	Apr. 27	s	r	Sept. 17.	f	5	5	4-5
84	Haas	1890	" 27	l	r	July 29.	f	3½	10	6
85	Hale	1888	" 25	l	g	" 30.	s	4	10	5
86	Hale Oblong	1888	" 25	l	g	" 27.	s	6	9	3-4
87	Hance Golden	1890	" 27	s	g	Aug. 19.	f	4½	8	8-9
88	Hance Smock	1890	" 27	s	r	Sept. 27.	f	4	9	4-5
89	Heath Cling	1890	" 27	s	r	" 28.	c	6¾	4	7-8
90	Hughes IXL	1892	" 25	l	r	--------	-------	----	----	--
91	Husted 101	1895	" 27	s	r	--------	-------	----	----	----
92	Husted 130	1895	-----	----	r	--------	-------	----	----	----
93	Husted 700	1895	Apr. 27	-----	g	--------	-------	----	----	----
94	Hyatt	1888	" 27	l	g	July 28	s	4	7	7
95	Hynes (Sur.)	1890	" 27	l	g	" 30.	s	3	8	5
96	Hyslop	1892	" 27	s	r	Sept. 22.	c	5¾	3	4
97	Ice Mountain	1894	" 27	l	r	Nov.	------	-----	----	-----
98	Infant Wonder	1892	" 25	s	g	Aug. 24.	f	----	----	-----
99	Ingold	1892	-----	----	--------	-----	-------	----	----	-----
100	Iron Mountain	1895	Apr. 27	s	r	Oct. 1.	f	5½	1	1
101	Jacques	--	----	----	-------	-------	-------	----	----	-----
102	Jacques Late	1890	Apr. 27	s	g	Sept. 8	f	4	6	-----
103	Japan Dwarf	1894	" 27	l	r	July 27.	f	3½	6	5
104	Jersey Yellow	1895	-------	----	-------	-------	-------	--	----	-----
105	Jones	1892	Apr. 27	s	g	Sept. 10.	s	6	3	5-6
106	June Rose	1890	" 23	l	g	Aug. 19	f	4¾	10	6-7
107	Juno	1894	" 27	-----	r	-------	-------	--	----	-----
108	Kalamazoo	1890	" 27	s	r	Aug. 31.	f	3¾	9	7-8
109	Kallola	1892	" 25	l	r	Sept. 7.	f	4¼	10	3-4
110	Krans 4	1896	--------	-----	--------	--------	--------	-----	------	-----

PEACHES.—CONTINUED.

Number.	Name.	Planted.	Bloomed.	Flowers—l, large; s, small.	Glands—g, globose; r, reniform; s, serrate.	Ripened.	Adhesion—f, free; s, semi cling; c, cling.	Weight of specimen in ounces.	Productiveness—scale (1-10).	Quality—scale (1-10).
111	Kraus 16	1896								
112	La Fleur	1895	Apr. 25	l	r	Sept. 24	f	2	1	2-3
113	Lancaster	1894								
114	Late Barnard	1893	Apr. 27	s	r	Sept. 4	f	4	4	5-6
115	Late White	1889	" 27	s	r	" 14	f	4¾	6	5
116	Lemon Cling	1888	" 27	s	g	Aug. 24	c	5½	8	6-7
117	Lemon Free	1894	" 27	l	r	Sept. 26	f	6	3	4
118	Lewis	1890	" 27	l	r	Aug. 4	f	7	6	7
119	Lock Cling	1892	" 27	s	g	Aug. 24	c	5½	8	6-7
120	Longhurst	1894	" 27	s	g	Sept. 21	f	8	1	3
121	Lorentz	1895	" 27	s	r					
122	Lovell	1893	" 24	s	g	Sept. 9	f	4	8	7-8
123	Lovett White	1892	" 27	s	r	" 10	f	4½	10	6-7
124	Magdala	1890	" 27	s	r	" 18	f	3½	10	4-4
125	Mammoth Heath	1892	" 25	l	r	" 18	c	4	8	3-4
126	Marshall	1890	" 27	s	r	" 18	f	3½	10	4-5
127	McCollister	1892	" 24	s	r	" 18	f	5¾	9	6
128	McKevitt	1892	" 27	s	g	" 23	c	6½	1	3-4
129	Milhiser	1892	" 27	s	g	" 26	f	3¾	1	6
130	Minerva	1896								
131	Minnie (Texas)	1890	Apr. 27	s	r	Aug. 13	f	4¾	10	5-6
132	Minnie (College)	1892	" 28	s	r	Sept. 28	f	6	1	4
133	Moore	1890	" 27	s	g	Aug. 27	f	3¾	8	7-8
134	Morris Co.	1890	" 27	s	r	Sept. 21	f	4	9	3-4
135	Morris White	1888	" 27	s	r	Aug. 31	f	4½	6	9
136	Mountain Rose	1888	" 25	s	g	" 10	f	4	10	8
137	Muir	1890	" 27	s	r	Sept. 4	f	5¾	9	5-6
138	Murat	1889	" 27	s	r	" 15	f	5	7	5-6
139	Mystery	1888	" 27	s	r	Aug. 10	f	4½	10	8
140	N. Am. Apt.	1892	" 27	l	r	Sept. 7	f	3½	9	5-6
141	Nectarine	1889	" 27	l	r	" 11	f	3½	10	5
142	Need	1890	" 27	s	r	Aug. 19	f	4½	6	5
143	Neil (Marshall)	1892	" 28	l	r	Sept. 23	f	5	3	4-5
144	Newington (free)	1893	" 27	s	r	" 24	f	4½	8	6
145	New Prolific	1894	" 27	s	g	" 5	f	5	1	7
146	Normand	1892	" 27	s	r	Oct. 1	c	4½	3	5
147	Oldmixon (cling)	1888	" 27	s	g	Aug. 31	c	4	9	5
148	Oldmixon (free)	1898	" 27	s	g	Sept. 10	f	6	5	9-10
149	Oriole	1894	" 27	?	r	" 14	s	4	1	4
150	Oscar	1894								
151	Ostrander	1892	Apr. 25	s	g	Aug. 10	f	4½	7	8
152	Pallas	1894	" 27	l	g					
153	Palmerston	1890	" 27	l	g	Sept. 3	f	7	6	7
154	Pansy	1890	" 25	s	r	Aug. 5	f	5	6	4
155	Pearl	1889	" 27	s	g	Sept. 4	f	4	9	7
156	Peninsular Yellow	1894	" 27	s	g	" 11	f	4	1	4-5
157	Pickett	1890	" 27	s	r	" 17	c	5½	5	5-6
158	Pratt	1890	" 27	s	r	Aug. 17	f	4	5	6
159	Prince (Rareripe)	1890	" 25	s	g	" 24	f	4½	7	7-8
160	Princess	1894	" 27	l	g	Sept. 20		5½	1	8-9
161	Princess (Wales)	1889	" 27	l	g	" 7	f	4	9	7
162	Prize	1892	" 25	s	g	" 14	f	5½	8	5-6
163	Prize 1	1890	" 27	s	r	" 3	f	4	6	4-5
164	Red Cheek (Mel.)	1893	" 27	s	g	" 4	f	4½	5	5
165	Red Seedling	1893	" 25	l	g	Aug. 7	f	4	8	6

PEACHES.—Concluded.

Number.	Name.	Planted.	Bloomed.	Flowers—l, large; s, small.	Glands—g, globose; r, reniform; s, serrate.	Ripened.	Adhesion—c, cling; f, free; s, semi-cling.	Weight of specimen in ounces.	Productiveness—scale (1-10).	Quality—scale (1-10).
166	Reed	1890	Apr. 25	s	g	Aug. 17	f	5¾	5	6-7
167	Reeves (Fav.)	1890	" 27	s	g	" 24	f	6	7	6-7
168	Ringold	1890	" 27	s	r	Sept. 18	c	4¾	6	6-7
169	River Bank	1892	" 27	l	r	July 13	s	5	8	5
170	Rivers	1888	" 27	l	r	" 23	s	5½	10	7
171	Robena	1894	----	----	----	----	----	----	----	----
172	Roser	1892	Apr. 25	l	r	Sept. 28	f	8	8	3-4
173	Roseville	1892	" 27	l	g	" 4	c	9¾	5	5
174	R. S. Stevens	1891	" 25	s	r	Aug. 31	f	3½	9	4
175	Salway	1890	" 27	s	r	Sept. 21	f	4¾	6	6
176	Scott	1890	" 27	s	g	" 9	f	3¾	5	7
177	Sener	1888	" 25	s	r	Aug. 31	f	6	5	7-8
178	Shipley	1890	" 27	s	g	Sept. 4	f	5¾	3	4-5
179	Smock (free)	1888	" 28	s	r	" 14	f	5½	4	5-6
180	Smock X	1892	" 28	s	r	" 17	f	5¾	10	5-6
181	Sneed	1896	----	----	----	----	----	----	----	----
182	Snow Late	1890	Apr. 27	s	r	Aug. 17	f	4	7	6
183	Southern Early	1890	" 25	s	r	" 17	f	4	4	6
184	Spottswood	1894	" 27	l	r	Sept. 11	f	4½	1	5
185	Stark Heath	1892	" 25	s	r	Oct. 1	c	5¾	6	7
186	Steadly	1888	" 27	s	r	Sept. 21	f	5	7	7-8
187	Stevens Late	1890	" 27	s	r	" 16	f	3	6	4-5
188	Stevens Rareripe	1892	" 27	s	r	" 9	f	5½	7	7
189	St. John	1890	" 27	s	g	Aug. 1	f	6	6	7-8
190	Strong (Mam.)	1892	" 27	s	g	Sept. 11	f	5¾	3	6
191	Stump	1890	" 25	s	g	Aug. 8	f	4½	10	6
192	Summer Snow	1894	" 27	l	g	Sept. 22	c	3¾	2	4-5
193	Surpasse (Mel.)	1890	" 27	s	r	Aug. 17	f	4	4	8
194	Switzerland	1890	" 27	s	g	Sept. 4	f	4¾	5	5-6
195	Tallman 1	1894	----	----	----	----	----	----	----	----
196	Tallman 2	1894	----	----	g	----	----	----	----	----
197	Tallman 3	1894	----	----	g	----	----	----	----	----
198	Toledo	1894	Apr. 27	l	g	Aug. 6	f	3¾	2	6
199	Toquin	1892	" 27	l	r	Sept. 3	f	3¾	7	7
200	Townsend	1894	" 27	s	g	" 12	f	6	5	5-6
201	Triumph	1896	----	----	----	----	----	----	----	----
202	Troth	1890	Apr. 25	s	g	Aug. 10	f	3¾	10	4-5
203	Tuskena	1893	" 25	s	r	Sept. 22	c	5½	1	8-9
204	Wager ?	1891	" 27	s	r	" 14	f	4½	4	----
205	Walker	1892	" 27	s	g	" 15	f	7½	6	6-7
206	Walker Var.	1890	" 27	s	g	" 12	f	4¾	9	7-8
207	Washington	1890	" 27	s	g	Aug. 31	f	6¾	6	3-4
208	Waterloo	1888	" 28	l	r	July 6	s	3	10	5
209	Willett	1894	" 27	l	r	----	----	----	1	----
210	Williamson	1892	" 27	s	g	Sept. 12	f	6	9	5-6
211	Wonderful	1890	" 27	s	r	" 21	f	5¾	8	5
212	Worthen	1893	" 25	s	r	Aug. 20	f	6	8	8
213	Yellow Rareripe	1888	" 27	s	g	" 18	f	3	7	3-4
214	Yenshi	1896	----	----	----	----	----	----	----	----
215	York Pearl	1896	----	----	----	----	----	----	----	----
216	Zella	1896	----	----	----	----	----	----	----	----

NOTES ON VARIETIES.

Peaches Ripening in July—All Semi-clings.

Waterloo was the earliest to ripen; and, so far, one of the most productive. Champion, a seedling from Allegan, Michigan, is a serrate-leaved variety which, for several years, was considered worthless, on account of the mildewing of the foliage and young wood, usually so injurious to varieties of this type which, however, yields readily to the copper-sulphate treatment, applied to the dormant plant. Under this treatment, the variety proves fairly productive and vigorous, and less clingy than most others ripening at this season.

River Bank, received from Missouri, and Canada, from Ontario, follow the foregoing very closely.

Alexander and Amsden, although of distinct parentage, may, for all practical purposes, be considered identical. Although scarcely equal in quality to Waterloo, they are almost the sole representatives of this type of peaches in western Michigan.

Rivers, an English seedling, easily takes rank as the best, most beautiful and profitable of the early semi-clings.

Hyatt, Hale X (a seedling by C. Engle, of Paw Paw, Michigan), Japanese Dwarf, Haas, Hale and Hynes, have all ripened this year, in the order given, within the month of July.

Varieties Ripening in August.

Of the varieties which fruited at the station this season, sixty-eight ripened during the month of August. Of these the following thirteen ranked from nine to ten in productiveness, viz: Amelia, Bequett free, Early Barnard, Early Crawford 1 and 3 (of C. Engle), Early Michigan (16), June Rose, Kalamazoo, Minnie (of Texas), Mountain Rose, Muir, Mystery and Stump (World); while, of the same, barely four, viz: Champion (of Ohio), Early Michigan, Engle (Mam.), and Morris White, grade as high as nine to ten in quality.

September Varieties.

Of the remaining varieties fruiting this year, ninety-two ripened during September, of which the following twenty-six are graded at nine to ten for productiveness, viz.: Allen, Bonanza, Blood Leaf, Chili, Chili 2 (of Engle), Columbia, Crothers, Geary, Gold Drop, Hance Smock, Kallola, Lovett White, Magdala, Marshall, McCollister, Morris Co., Muir, N. Am. Apt, Nectarine, Oldmixon free, Pearl, Princess (Wales), Smock X, Walker Var., and Williamson, of which only a single variety, the Oldmixon free, ranks as high as nine to ten in quality.

October Varieties.

Iron Mountain, Normand and Stark Heath matured during the early days of October. Brett was assumed to be mature on or about the middle of the month, while the first crop of Ice Mountain was yet immature when the first freezing weather occurred during the latter half of the month.

GRAPES.—(*Vitis*).

The fact will doubtless be recollected that, during the spring of last year, a severe frost occurred, after the growth of the young canes was well advanced, which nearly or quite ruined the incipient canes. The injured canes were allowed to remain; and many of the buds upon them subsequently developed new canes. These, together with the additional canes subsequently produced from the old wood, soon multiplied the number of young canes beyond the ability of the plants to produce strong fruiting wood for the following year, rendering it highly probable that the better practice would have been to entirely remove the injured growths, and depend wholly upon new growths from dormant buds. Many of the weaker canes were cut away when the error became obvious, although too late to insure the best results.

The crop of this year has apparently been considerably diminished from this cause.

The spray of copper sulphate (one pound in twenty-five gallons of water), with which all dormant plants were treated, was applied to grapes on April 15th.

On June 12th, grapes were sprayed, to prevent anthracnose, with a solution of one pound of copper-sulphate in 200 gallons of water.

On July 11th to 21st, finding indications of mildew, grapes were again treated with a solution of one pound of copper-sulphate in 250 gallons of water.

Mildew proving unusually persistent, the latter solution was again applied on August 4th and 5th, and again on the 13th.

No attacks of either fungi or insects have proved troublesome, beyond those already specified.

In the column headed Parentage, in the following table, the species of the mother or seed parent is first given, and followed by the known or supposed cross. In the determination of such parentage, the writer has been very kindly aided by Prof. T. V. Munson, of Texas, who is generally recognized as the leading expert in this country, so far as the botany of the grape is concerned.

In the great majority of cases, the actual parentage can only be inferred from the characteristics of the resultant plant, or the tendencies manifested in seedlings therefrom; it will therefore be understood that, in many cases, conclusions are drawn from such premises.

GRAPES.

Number.	Name.	Parentage.	Planted.	Bloomed.	Ripened.	Form—c, compact; y, cylindrical; l, long; o, oval; r, round; s, shouldered. Bunch.	Form—Berry.	Color—a, amber; b, black; r, red; w, white.	Weight of bunch in ounces.	Productiveness—scale (1-10).	Quality—scale (1-10).
1	Adirondac	Lab. x Vin.	1890	June 8.	Aug. 2	l c s	----	b	---	8	5
2	Agawam	Lab. x Vin.	1888	May 27	m Sept.	l s	r	b	5	7	6-7
3	Aminia	Lab. x Vin.	1888	" 27.	m Sept.	l s	r	b	5	8	7-8
4	Aug. Giant	(Rip. x Lib.) x Vin.	1889	June 1.	b Sept.	l s	r	b	4	1	5
5	Barry	Lab. x Vin.	1888	May 29.	m Sept.	r c s	r	b	4	7	7
6	Beagle	----	1889	" 25.	Aug. 9.	y o	r	b	2	5	5
7	Bell	Elvira x Dela.	1889	" 25	b Sept.	y o	r	w	3	7	8
8	Belvidere	Lab.	1892	" 25.	Aug. 20.	c s	r	b	4	9	6
9	Berckmans	Clinton x Dela	1892	" 25.	e Sept.	l o	r	r	2	7	8-9
10	Berlin	Lab.	1893	----	----	----	----	----	---	---	----
11	Black Eagle	Lab. x Vin.	1890	June 1	m Sept.	l c s	o	b	4	3	6
12	Black Pearl	Rip. x Lab.	1892	May 25	b Oct.	y o	r	b	---	3	3-4
13	Blanco	----	1889	" 26	m Sept.	y s	r	w	4	6	4
14	Brighton	Lab. x Vin.	1888	" 29.	b Sept.	l s	r	r	6	3	10
15	Brilliant	Lab. x Vin.	1889	June 1.	m Sept.	y c s	r	r	4	9	9-10
16	Brunette	Lab. x Vin	1892	----	----	----	----	----	---	---	----
17	Cambridge	Lab.	1890	May 27	Sept. 20.	y s	r	b	4	4	7
18	Catawba	Lab. x Vin.	1888	" 29	m Oct.	l c s	r	r	3	5	8-9
19	Caywood 50	Lab.	1888	" 25	b Sept.	l	r	b	8	10	6-7
20	Centennial	Lab. x Vin.	1892	June 3	e Sept.	y s	r	w	8	10	10
21	Challenge	Lab. x Vin.	1892	May 25.	----	----	----	----	---	---	----
22	Champion	Lab.	1889	" 25	Aug. 19.	c s	r	b	3	7	3-4
23	Chidester 3	Lab.	1892	" 30.	Aug. 31	r s	r	a	3	8	9
24	Chidester 4	Lab.	1892	June 3	m Sept.	r	r	b	3	3	6-7
25	Clark	----	1892	----	----	----	----	----	---	---	----
26	Clevener	Rip. x Lab.	1892	May 25	Aug. 15.	y	r	b	3	5	4
27	Clinton	Rip. x Lab.	1891	" 25.	l Sept.	c y s	r	b	3	3	4
28	Colerain	Lab.	1892	" 29.	m Sept.	c	r	w	---	1	8
29	Columbia	Rip. x Lab.	1891	" 29.	----	----	----	----	---	---	----
30	Columbian	Lab.	1895	----	m Sept.	l	r	r	---	1	4
31	Concord	Lab.	1888	May 29	e Sept.	y s	r	b	6	8	6-7
32	Cortland	Lab.	1890	" 25	e Aug.	o s	r	b	4	3	3-4
33	Cottage	Lab.	1890	" 25.	b Sept.	y	r	b	4	7	5
34	Creveling	Lab. x Vin.	1890	" 23.	m Sept.	----	r	b	-	1	----
35	Delaware	Bour. x Lab. ?	1888	" 29	m Sept.	c s y	r	r	5	8	10
36	Diamond	Lab. x Vin.	1889	" 26	b Sept.	l c s	r	w	5	8	7-8
37	Diana	Lab. x Vin.	1888	" 27.	e Sept.	c y	r	r	4	3	6-7
38	Downing	Æst. x Vin.	1888	June 3.	e Sept.	l c s	o	b	7	10	9-10
39	Dracut	Lab.	1891	May 25.	Aug. 31	y s	r	a	4	3	2-3
40	Duchess	Lab. x Vin.	1888	June 4.	e Sept.	l s	r	w	7	9	10
41	Early Golden	Lab. x Vin.	1889	May 26.	Aug. 19	---	r	w	2	7	5
42	Early Market	Lab. x Rip.	1889	" 26.	Aug. 31.	o s	r	b	3	8	8
43	Early Victor	Lab. x (Bour. x Lab.)	1888	" 26.	Aug. 31.	o c s	r	b	4	7	7-8
44	Eaton	Lab.	1888	" 29.	m Sept.	l s	r	b	8	9	6
45	Elaine	Lab. x Vin.	1889	" 29.	----	----	----	----	---	---	----
46	El Dorado	Lab. x Vin.	1889	June 1.	----	----	----	----	---	---	----
47	Elvira	Lab. x Rip.	1892	May 25.	m Sept.	y	r	w	4	7	4
48	Empire State	Lab. x Vin.	1888	June 1.	e Sept.	y s	r	w	6	7	8-9
49	Essex	Lab. x Vin.	1889	June 1.	m Sept.	c s	o	a	4	8	3-4
50	Esther	Lab. x Vin.	1892	May 29.	m Sept.	y	r	w	---	7	4
51	Etta	Lab. x Rip.	1892	" 26.	m Oct.	c s	r	w	4	7	4-5
52	Eugenie	Lab.	1891	" 29.	m Sept.	l o	r	r	--	1	----
53	Eumelan	Lab x Vin.	1888	June 1.	m Sept.	l s	r	b	5	9	8
54	Eva	Lab.	1889	May 26.	b Sept.	c s	r	w	----	8	3-4
55	Faith	Lab. x Rip.	1891	" 25.	b Sept.	----	r	w	---	1	5

GRAPES.—Continued.

Number.	Name.	Parentage.	Planted.	Bloomed.	Ripened.	Form—c, compact; r, cylindrical; l, long; o, oval; r, round; s, shouldered. Bunch.	Berry.	Color—a, amber; b, black; r, red; w, white.	Weight of bunch in ounces.	Productiveness—scale (1-10.)	Quality—scale (1-10).
56	Gaertner	Lab. x Vin.	1889	June 1.	m Sept.	---	r	r	---	8	5
57	Geneva	Lab. x Vin.	1892	" 1.	m Sept.	l o	o	w	8	1	5
58	Goethe	Lab. x Vin.	1889	May 30.	e Sept.	l s	r	w	4	7	5-6
59	Golden Drop	(Lab. x Vin.) x (Bour. x Lab)	1889	May 29	Aug. 27.	y s	r	w	2	8	9-10
60	Golden Gem	(Bour x Lab.) x Vin.	1891	" 25.	--------	----	-----	-----	---	---	-----
61	Guinevra	Lab. x Vin.	1892	" 30.	b Oct.	y c	o	w	6	8	3-4
62	Hall	Lab.	1893	" 29	m Sept.	c s	r	b	4	4	6-7
63	Hartford	Lab.	1889	" 30	e Aug.	l c s	r	b	4	4	3-4
64	Hayes	Lab.	1888	" 29.	b Sept.	y s	r	w	4	8	6-7
65	Herbert	Lab. x Vin.	1889	" 30.	m Sept.	l s	r	b	----	7	7
66	Honey	Lab. x Vin.	1892	" 23.	m Sept.	y s	r	w	3	2	7-8
67	Hosford	Lab.	1893	June 1.	m Sept.	y s	r	b	6	8	5-6
68	Ionia	Lab. x Vin.	1888	" 2	m Sept.	l s	o	w	7	9	10
69	Iris	Lab. x Vin.	1892	May 30	m Sept.	r o s	r	a	----	1	5-6
70	Isabella	Lab. x Vin.?	1888	" 27.	b Oct.	l s	o	b	5	7	8
71	Ives	Lab.	1890	" 25	e Sept.	y s	r	b	5	9	3-4
72	Janesville	Lab.	1889	" 25.	b Sept.	r y s	r	b	5	7	6
73	Jefferson	Lab. x Vin.	1888	June 4	e Sept.	r y s	r	r	8	8	8-9
74	Jessica	Bour x Lab.	1888	May 25	Aug. 22	y s	r	w	4	8	6
75	Jewell	Bour x Lab.	1890	" 29	Aug. 26	s	r	b	3	3	4
76	Josselyn 5	Lab.	1891	" 30	e Sept.	o y	r	w	----	5	4
77	Josselyn 7	Lab.	1891	June 6	e Sept.	y s	r	w	3	5	10
78	Josselyn 9	Lab.	1891	" 1.	e Sept.	y c	r	b	3	5	4-5
79	Josselyn 10	Lab.	1891	May 30	------	----	-----	-----	---	---	-----
80	Lady	Lab.	1888	" 29.	Aug. 27.	y	r	w	4	8	6
81	Leader	Lab.	1892	" 29	m Sept.	y o	r	w	----	7	5-6
82	Leavenworth	Lab.	1892	" 27	Sept. 20	c s	r	b	3	2	6-7
83	Lindley	Lab. x Vin.	1889	" 29.	e Sept.	l s	r	r	4	8	6-7
84	Lutie	Lab.	1894	" 25.	m Sept.	r	r	r	3	1	2-3
85	Mason	Lab. x Vin.?	1892	--------	m Sept.	r	r	r	---	1	9
86	Massasoit	Lab. x Vin.	1888	May 29	m Sept.	r s	r	r	4	7	6-7
87	Merrimac	Lab. x Vin.	1888	" 29	m Sept.	y	r	b	6	7	7
88	Michigan	Lab. x Vin.	1890	June 3.	b Sept.	r y	r	w	---	3	8
89	Millington	Lab.	1891	May 30	e Sept.	y c	r	b	6	7	5
90	Mills	Lab. x Vin.	1888	June 3.	e Sept.	l y s	r	b	7	9	10
91	Minnesota	Lab.?	1891	" 6.	------	-----	-----	-----	----	---	---
92	Monroe	(Bour x Lab.) x Lab.	1889	May 29	e Sept.	l s	r	b	4	1	6
93	Moore Early	Lab.	1888	" 26	Aug. 20	c s	r	b	8	9	5
94	Moyer	Bour x Lab.?	1888	" 26.	Aug. 20.	y s	r	r	3	2	6
95	Naomi	(Lab. x Rip.) x Vin.	1889	-------	--------	-----	-----	-----	---	---	-----
96	Nectar	Lab. x (Bour. x Lab.)	1888	May 26	m Sept.	y s	r	r	----	4	4-6
97	Niagara	Lab.	1888	" 25.	e Sept.	o s	r	w	7	3	5-6
98	Northern Light	Lab.	1890	June 7	m Sept.	y c s	r	w	4	10	7-8
99	Olita	Lab. x Vin.	1889	" 1.	m Sept.	y c	r	w	---	7	6
100	Oneida	Lab. x Vin.	1893	May 29	e Sept.	o c	r	r	3	3	6-7
101	Osage	Lab.	1892	" 29	Aug. 24	o	r	b	3	3	5
102	Owosso	Lab.	1892	" 30	e Sept.	r y s	r	a	4	2	4-5
103	Ozark	Est.	1892	------	m Oct.	y	r	b	3	1	5
104	Peabody	Rip	1892	May 29.	Aug. 19	l y	r	b	5	8	6
105	Perkins	Lab.	1890	" 25.	b. Sept.	c y s	r	a	3	8	2
106	Pocklington	Lab.	1888	" 26	Sept. 15.	y s	r	w	6	9	6
107	Poughkeepsie	Bour x Lab.	1888	June 3	b Sept.	y c	r	r	3	7	9-10
108	Prentiss	Lab. x Vin.	1890	May 29	m Sept.	y c	r	w	5	9	8
109	Presley	(Lab. x Rip.) x Lab.	1889	" 25.	e Sept.	y c s	r	r	3	8	4-5
110	Progress	Lab. x Vin.	1892	June 1.	e Sept.	c r	r	b	6	7	10

GRAPES.—CONCLUDED.

Number.	Name.	Parentage.	Planted.	Bloomed.	Ripened.	Form—c, compact; y, cylindrical; l, long; o, oval; r, round; s, shouldered. Bunch.	Berry.	Color—a, amber; b, black; r, red; w, white.	Weight of bunch in ounces.	Productiveness—scale (1-10).	Quality—scale (1-10).
111	Pulpless	Lab. x Vin.	1892	May 29	------	-----	-----	-----	---	---	-----
112	Rentz	Lab.	18·9	" 26	m Sept.	c s	r	b	---	7	3-4
113	Requa	Lab x Vin.	1892	" 29.	m Sept.	c y s	r	r	4	2	7-8
114	Rochester	Lab. x Vin.	1892	" 29.	m Sept.	y c s	r	r	5	10	7-8
115	Rockwood	Lab.	1892	" 27.	Aug. 31.	l c s	r	b	4	7	7-8
116	Rogers 5	Lab. x Vin.	1889	June 1.	m Sept.	r c	r	r	..	8	8
117	Rogers 8	Lab. x Vin.	1889	May 29.	Sept. 15.	r c	o	b	6	7	7
118	Rogers 24	Lab. x Vin.	1889	" 29.	e Sept.	c s	r	r	6	7	6-7
119	Rogers 30	Lab x Vin.	1889	" 27	e Sept.	c s	r	r	3	7	5
120	Rommell	(Lab. x Rip.) x Vin.	1889	" 26.	e Sept.	c s	r	w	4	5	4-5
121	Salem	Lab. x Vin.	1888	" 27.	m Sept.	c s	r	r	.	7	4-5
122	Secretary	(Lab. x Rip.) x Vin.	1892	" 26.	m Sept.	c s	r	b	8	9	8
123	Telegraph	Lab.	1892	" 26.	Aug. 27.	c s	r	b	5	7	5-6
124	Themis	Lab. x Vin.	1892	June 1.	m Sept.	c s	r	b	5	7	5-6
125	Triumph	Lab. x Vin.	1892	" 6.	m Oct.	l c s	r	w	12	6	?
126	Ulster	Lab. x Vin.	1888	May 25.	Sept. 16	y c	r	a	4	8	9-10
127	Vergennes	Lab.	1889	" 26.	m Sept.	l c s	r	r	5	9	7
128	Vesta	Lab. x Vin.	1891	------	------	-----	-----	-----	---	---	-----
129	Victoria (white)	Lab.	1892	May 29	------	-----	-----	-----	---	---	-----
130	Victoria (black)	Lab.	1891	" 30.	b Oct.	l y	r	b	6	8	6
131	Warder	Lab.	1892	------	------	-----	-----	-----	---	---	-----
132	Washington	Lab. x Vin.	1888	June 3.	Oct. 1.	l c s	r	w	6	7	6-7
133	Wells	Lab.	1892	May 25.	------	-----	-----	-----	---	---	-----
134	White Ann Arbor	Lab.	1889	------	b Sept.	c	r	w	3	1	5
135	White Beauty	Lab. x Vin.?	1892	June 4.	e Sept.	y c	r	w	3	1	6
136	White Imperial	Lab. x Vin.?	1892	May 29.	b Sept.	y	r	w	3	7	6-7
137	Wilder	Lab. x Vin.	1888	" 26.	m Sept.	s	r	b	5	6	7-8
138	Willis	Est. x ?	1892	" 29.	b Sept.	c s	r	w	---	7	5-6
139	Winchell	Lab. x Vin.	1889	" 29.	Aug. 15.	l c s	r	w	5	9	9-10
140	Witt	Lab. x Vin.	1889	June 1.	e Sept.	c s	r	w	5	8	7-8
141	Woodruff	Lab. x Vin.	1888	May 25	m Sept.	r s	r	r	5	5	5-6
142	Worden	Lab.	1888	" 27	e Aug.	l s	r	b	6	9	7-8
143	Wyoming	Lab.	1888	" 26.	b Sept.	l s	r	r	3	6	4

The Rogers' hybrids, of which no less than sixteen are here tabulated, although the berries are generally of fine size and fair quality, and the plants vigorous, under ordinary treatment, frequently produce so large a percentage of imperfect clusters, and are withal so liable to mildew that they scarcely take rank as commercial varieties, while they hold but a questionable position in the amateur or home list.

Elaine, Guinevra, Honey, Michigan, Olita, Pulpless, Themis and Vesta are seedlings by C. Engle, of Michigan, from one or another of the foregoing, which are in process of being tested here, some of which appear very promising, though requiring farther trial to justify a confident conclusion respecting them.

Beagle, Bell, Blanco, Brilliant, Early Market and Presley are seedlings by T. V. Munson, of Texas, several of which prove successful farther south, but are evidently beyond their lattitude here.

Berckmans, Centennial, Duchess, Golden Drop, Golden Gem, Moyer, Poughkeepsie, Prentiss, and perhaps a few others, though often good and several of them of excellent quality, either from feebleness of plant or

special liability to disease are scarcely desirable, unless, possibly to the curious and painstaking amateur; although the thorough and persistent use of fungicides may be expected, in most cases, to insure satisfactory returns of fruit of superior quality.

Brighton, Delaware, Downing, Empire State, Iona, Jefferson, Mills, Washington (Lady) and Winchell are all of high and several of them are of superior quality, and, although they possess more or less of Vinifera blood, and may therefore be the more liable to mildew, such tendency is comparatively slight and easily controlled; while, generally, they are sufficiently vigorous and abundantly productive under judicious management.

Catawba, Triumph and (in many localities), Isabella, although of fine quality when well ripened, can scarcely be relied on to thoroughly mature in this latitude, except in favorable seasons or in specially favorable locations.

Berlin and Hosford originated at Ionia, Michigan. They are not yet sufficiently tested here.

Chidester 3 and Chidester 4 are promising seedlings originated by a gentleman of that name near Battle Creek, Michigan.

Hall is a recent seedling of southern Michigan, which gives promise of value, as an early market grape.

Mason (the name of the lady originator), is an Ottawa county seedling which fruited here for the first time this season. The fruit is of superior quality.

Owosso originated many years since, in the town of that name. It is a seedling of Catawba, which it resembles, in color and general appearance, though ripening earlier.

White Ann Arbor and Woodruff originated at Ann Arbor, Michigan. They give little promise of value for this locality.

Diamond, Early Victor, Eumelan, Josselyn 7, Lady, Progress (identical with Norfolk), Rockwood, Ulster and Witt are hardy and productive varieties of fair to good quality, suitable for the home plantation.

Vergennes, Worden and Northern Light (the last a recent Ontario seedling), while suitable for home planting are, at the same time, desirable for the market.

Jewell, Leavenworth, Osage, Ozark, White Beauty and White Imperial, were received from Dr. Stayman, of Kansas, and have now fruited; some of them, the last especially, give indications of value, though farther trial is needful to properly determine their status.

Plants under the name Victoria have been received from several sources. Among these, one proves to be a black grape and an other white; and since both purport to have originated with the late Mr. Miner, it becomes a question which is entitled to the name.

Among those not mentioned in these notes are many desirable and popular varieties which, if of real value, are generally too well known to require special mention.

PLUMS—(*Prunus*).

Whether caused by the copper sulphate spray applied in April to plums in common with all other fruits, or from other cause, the plum trees have been notably exempt from the attacks of fungus, except that there was a very considerable loss of fruit from rot (*Monilia fructigena*) during the month of September, this being its first appearance upon the plum upon the station grounds, although it had been slightly noticeable, a year earlier, upon some of the earlier peaches.

The crescent of the curculio was observed, and the jarring process commenced as early as May 14, finding a good many insects. The jarring was continued, except during high winds, till June 12, when the insect had disappeared.

The first rose chafer (*Macrodactylus subspinosus*) was discovered on May 27, and a few as late as June 5, after which date no more were seen. A few were caught upon roses, though they have been conspicuous this year by their absence.

This year's crop of plums was comparatively light, due doubtless to the excessive crop of last season.

PLUMS.

Number.	Name.	Species.	Planted.	Bloomed.	Ripened.	Color—b, black; p, purple; r, red; w, white.	Adhesion—c, cling; f, free.	Weight of specimen in ounces.	Productiveness—scale (1-10).	Quality—scale (1-10).
1	Abundance	Hattan	1895	Apr. 27						
2	Agen Prune	Domestica	1890	" 25	Aug. 14	p	f	½	1	
3	Archduke	Domestica	1892	" 23	" 25	b	f	1½	1	3-4
4	Arctic	Domestica	1890	" 27	July 27	b	f	¾	10	5
5	Baker Prune	Domestica	1893	" 27						
6	Bavay	Domestica	1890	" 22	m Sept.	w	c	1½	8	10
7	Black Diamond	Domestica	1892	" 25	Aug. 19	b	f	2	10	5-6
8	Black Prune	Domestica	1888	" 27	" 1	p	c	1½	10	4
9	Botan	Hattan	1890	" 21	July 20	r	c	2	4	6
10	Bradshaw	Domestica	1890	" 24					10	
11	Burbank	Hattan	1893	" 24	July 20	r	c	2	8	6
12	Burbank 2	Hattan	1890	" 22	" 25	r	c	2	10	7
13	Burbank 7	Hattan	1890	" 21	Aug. 27	w	f	2	5	7
14	Chabot	Hattan	1890	" 27	" 15	r	c	1½	2	5
15	Coe	Domestica	1893	" 27	m Sept.	w	c	2	8	6
16	Cook	Hortulana ?	1890	" 25	July 29	r	c	¾	10	4
17	Czar	Domestica	1890	" 25						
18	De Soto	Americana	1888	" 29	Aug. 20	r	c	1	8	
19	Engle	Domestica	1890	" 25	July 25	w	f	1	5	8-9
20	Englebert	Domestica	1890	" 25	Aug. 13	b	f	¾	8	6-7
21	Field	Domestica	1892	" 27	" 8	b	c	2	1	4
22	Forest Garden	Americana	1889	" 28	" 18	r	c	1	5	5
23	Forest Rose	Hortulana	1890	" 28	" 28	r	c	1	1	5-6
24	French Damson	Domestica	1893	" 29						
25	Garfield	Hortulana	1889	May 1						
26	Glass	Domestica	1890	Apr. 25	Aug. 8	b	c	1¾	1	6
27	G. No. 4	Domestica	1896	" 27	" 29	p	c	2	1	7-6
28	Grand Duke	Domestica	1890	" 22	Sept. 9	b	c	2¾	10	5-6
29	Gueii	Domestica	1890	" 25	Aug. 3	p	f	1	4	5-6
30	Hungarian	Domestica	1888	" 28	July 31	b	f	1½	5	5-6

PLUMS.—CONCLUDED.

Number.	Name.	Species.	Planted.	Bloomed.	Ripened.	Color—b, black; p, purple; r, red; w, white.	Adhesion—c, cling; f, free.	Weight of specimen in ounces.	Productiveness—scale (1-10).	Quality—scale (1-10).
31	Jewell	Americana	1890	Apr. 29	July 30	r	c	1	5	3-4
32	Kingston	Domestica	1890	" 24	Aug. 15	b	c	2⅜	10	6
33	Lincoln	Domestica	1890	" 27	----	----	----	----	----	----
34	Lombard	Domestica	1890	" 27	Aug. 3	p	c	1	10	5
35	Long Fruited	Hattan	1890	" 24	July 18	r	c	1½	3	4
36	Lyon	Domestica	1890	" 27	" 31	w	f	2	9	7-8
37	Maquoketa	Americana	1888	" 29	Aug. 23	r	c	1	5	9-10
38	Mariana	Cerasifera	1890	" 27	July 27	r	c	1	3	2-3
39	Maraunka	Domestica	1888	" 27	" 25	p	f	2	3	7
40	Maru	Hattan	1890	" 24	" 26	r	c	1	4	5
41	Middleburg	Domestica	1890	" 24	Sept. 4	w r	f	1	4	8
42	Miner	Hortulana	1890	" 29	" 1	r	c	1	6	3-4
43	Moldavka	Domestica	1888	" 27	July 30	w	f	2	2	6-7
44	Monarch	Domestica	1893	" 24	Sept. 15	p	c	1⅜	2	7
45	Moreman	Hortulana	1890	" 30	July 26	r	c	1	4	6
46	Murdy	Domestica	1892	" 29	----	----	----	----	----	----
47	Naples ?	Domestica	1889	" 27	Aug. 3	p	f	1	5	5-6
48	Newman	Angustifolia	1890	May 4	----	----	----	----	----	----
49	Niagara ?	Domestica	1890	Apr. 27	Aug. 3	p	f	1	1	6
50	Nicholas (White)	Domestica	1890	" 27	" 14	p	c	1¼	1	5
51	Ogon	Hattan	1890	" 25	July 13	w	f	1¾	1	3
52	Orel 20	Domestica	1888	" 28	" 30	b	f	⅜	2	2-3
53	Pissard	Myrobalan	1889	" 27	----	----	----	----	----	----
54	Pottawattamie	Hortulana ?	1894	" 29	----	----	----	----	----	----
55	Prairie Flower	Hortulana	1890	" 29	Sept. 1	r	c	¾	1	4-5
56	Red June	Hattan	1894	" 30	----	----	----	----	----	----
57	Red Nagate	Hattan	1890	" 27	July 29	r	c	1¾	9	4-5
58	Robinson	Angustifolia	1890	" 29	Aug. 1	r	c	¾	7	5
59	Saratoga	Domestica	1890	" 27	" 4	r	f	1	10	6
60	Satsuma	Hattan	1890	" 25	" 24	p	c	2¾	10	7-8
61	Sergent (Robe)	Domestica	1893	Apr. 27	----	----	----	----	1	----
62	Shipper (Pride)	Domestica	1890	" 27	Aug. 10	b	c	1¾	1	4-5
63	Shiro Smomo	Hattan	1890	" 23	July 8	p	c	1½	9	5
64	Shropshire	Domestica	1890	" 27	Aug. 25	b	f	1	9	3-4
65	Simon	Simoni	1888	" 21	July 21	r	c	----	----	----
66	Spanish King	Domestica	1890	" 25	Aug. 4	p	f	1½	10	6
67	Spaulding	Domestica	1890	" 27	----	----	----	----	----	----
68	Van Buren	Americana	1890	" 29	----	----	----	----	4	----
69	Victoria	Domestica	1890	" 27	Aug. 6	r	f	2	10	6-7
70	Wales (Prince)	Domestica	1892	" 29	----	----	----	----	----	----
71	Wangenheim	Domestica	1890	" 28	Aug. 4	----	----	----	2	----
72	Weaver	Americana	1890	" 28	" 24	r	f	1	6	2-3
73	Wickson	Hattan	1895	" 27	" 3	r	----	3	3	5-6
74	Wolf	Americana	1888	" 29	" 20	r		⅜	7	3-4
75	Wyant	Americana	1890	" 29	" 24	w r	f	1	10	2-3
76	Yellow Aubert	Domestica	1888	" 27	" 31	w	c	3	9	7
77	Yellow Egg	Domestica	1893	" 27	----	----	----	----	1	----
78	Yosebe	Hattan	1890	" 24	July 1	p	c	¾	5	3
79	Yosemite Yellow	Americana	1892	" 28	----	----	----	----	----	----

NOTES ON VARIETIES.

Domestica Varieties.

Agen Prune, so far, proves to be a slow grower and a tardy bearer. It showed its first fruit here this year.

Archduke also showed its first fruit at the station this year. It is vigorous and promises well as a market variety.

Bavay, commonly, but improperly, catalogued as Reine Claude, is popular as a late amateur as well as market plum. The full original name, Reine Claude de Bavay, is an unfortunate one, not only on account of its length, but also from its liability to become confounded with the old Green Gage or Reine Claude, an even finer fruit, but now little grown on account of the unsatisfactory character of the tree.

Black Diamond, Grand Duke and Kingston are quite late, very large, productive and showy market plums. The last two, especially, promise to take high rank as commercial varieties.

Bradshaw still holds a prominent position as a market variety.

Lombard, so long a leading market variety, although very productive, is apparently giving place to more modern varieties of superior quality.

Engle, although of high quality, is not, on account of its size, considered by the originator to be worthy of dissemination.

Hungarian.—Two varieties of this name are under trial. One, received from Iowa, is understood to be from Prof. Budd's Russian importation. The other was received, without a history, from the Michigan Agricultural College. Which is genuine is yet to be determined.

Lyon.—This is the variety appearing in previous reports as Bailey; received from S. S. Bailey, of Kent county, Michigan. A Japanese variety having been previously thus named, in honor of Prof. L. H. Bailey, of Cornell, the Michigan State Horticultural Society, at its recent annual session, re-named this Lyon. It is likely to take rank as a profitable, light colored market plum, of quality good enough for family use. It ripened this season early in August.

Middleburg showed its first fruit at this station this year; in quality it is very good, but farther trial is needful to properly determine its status.

Marunka and Moldavka, from the European importations of Prof. Budd, have now fruited three successive years. They are of fine size and good quality, but, so far, lack productiveness.

Gueii, Naples and Niagara.—Trees received under these names have now fruited three years. The last two, if not even the first, are apparently identical with Lombard.

Saratoga is a beautiful and productive variety of fine quality. Its color and size render it desirable for the market. A spurious variety was also received under this name.

Victoria also, as far as tested, appears to possess valuable qualities for both home and market purposes.

Yellow Aubert has, so far, proved to be the finest, largest and most productive of the varieties of plums received from the Budd importations.

A very considerable number of varieties of this species, both new and old have, this year, shown fruit at the station for the first time, but notices of these are deferred to await a farther trial.

Native American Varieties.

Many of these are quite popular at the west and northwest, where the *domestica* varieties fail from one cause or another. Few of them are desirable where the latter can be successfully grown. Robinson, De Soto. Moreman and Hawkeye, which are named as nearly as may be, in the order of their apparent desirability here, are among the most promising of these

Garfield is exceedingly unproductive, and Golden Beauty, on the other hand, is wonderfully prolific. Both are exceedingly vigorous and hardy, but ripen quite too late for this climate.

Hattan or Japanese Varieties.

Many if not most of these varieties, so far as tested here, seem so inclined to overbear as to seriously endanger the health and longevity of the trees, while their tendency to early blooming is quite likely to, in some degree, diminish their value for localities liable to late spring frosts.

In most lake shore localities, where late spring frosts are rare, several of these are likely to prove useful for market purposes, though, of those so far tested here, none will compare, in flavor, with very many of the *domestica* varieties.

They also generally have the peculiar habit of parting from the stem as soon as ripe, so that, since they ripen more or less in succession, it becomes necessary to go over the trees several times before all are gathered.

Abundance, so long popular among market planters, is found to be identical with one of the Botans.

Burbank, which, more recently, has become quite popular, is larger than Abundance and slightly better flavored. The tree is a vigorous, very spreading grower, and abundantly productive.

Chabot is somewhat later than Burbank and by no means its equal in quality.

Long-fruited, as received here, judging by the name, may very probably be spurious. It is apparently identical with Yosebe, which is a small, round plum, of rather poor quality, ripening here, this year, as early as July first.

Ogon, though of fine size, attractive appearance, and very productive, is of quite indifferent flavor.

Red June has not yet shown fruit here. Elsewhere it is commended as valuable.

Red Nagate, as received here from Georgia, is beautiful, productive and excellent, but notices of it from elsewhere indicate that, as fruited here, it may be incorrect.

Maru and Shiro Smomo are much alike in most particulars, only differing slightly in season of ripening. Both are, in many respects, similar to Abundance, though differing in season and in the habits of growth.

Satsuma is a curiosity, with a dark purple skin; the flesh is even darker, with an unusually small pit. The tree is very productive and the fruit large, ripening rather late. It is excellent for culinary purposes.

Wickson fruited heavily here, this season, on cions of but a single season's growth. The foliage is like that of Kelsey, but, unlike that variety, it ripens its wood early, and so far, proves entirely hardy here. Fruit of the form and size of Kelsey. It ripened here, this season, on August third. Weight of an average specimen, above three ounces; quality, medium or above.

PEARS.—*Pyrus communis.*

The spring of 1896, down to nearly or quite the middle of June, proved excessively dry; the showers were few and too slight for any permanent benefit. The remainder of the season has been more favorable, though the rainfall has at no time been excessive.

A considerable number of varieties have fruited here this season, many of them for the first time, though, in most cases, the crop has been light.

The spray, with a strong solution of copper sulphate, applied while growth was yet dormant, has apparently sufficed to prevent the attacks of fungi upon the pear. No treatment, for this purpose, has since been found needful.

PEARS (*Pyrus communis*).

Number.	Names.	Planted.	Bloomed.	Ripened.	Weight of specimen in ounces.	Productiveness—scale (1-10).	Quality—scale (1-10).
1	Alphand	1893	Apr. 30				
2	Angouleme	1891	" 28	m Sept.	8	1	5
3	Anjou	1888	" 30				
4	Ansault	1889	" 28	b Sept.	6	10	6
5	Barry (P.)	1892	" 29	Nov.-Dec.	5	10	5-6
6	Bartlett	1891	" 29	b m Sept.	8	3	6
7	Bloodgood	1888	" 28	Aug. 3	4	10	8
8	Bosc	1888	" 30	Sept.-Oct.	8	1	10
9	Clairgeau	1891	" 28				
10	Clapp Favorite	1888	" 29	Aug. 8	8	1	6
11	Congress (Souv.)	1890	" 30				
12	Coreless	1891	" 28	e Aug.	8	10	5-6
13	Dana-Hovey	1888	" 28	e Oct.	4	3	10
14	Dearborn	1891	" 29				
15	Duhamel	1891	" 28	Sept. 26	5	8	2-3
16	Early Duchess	1892	" 30	m Sept.	6	2	6-7
17	Elizabeth (Manning)	1891	" 29	Aug. 13	3	1	9-10
18	Fitzwater	1891	" 29	e Sept.	3	4	9
19	Gakovsk	1888	" 29				
20	Giffard	1888	" 28	July 27	4	10	8
21	Gray Doyenne	1888	" 29	Oct.	4	1	9
22	Hardy	1888	" 29				
23	Hoosic	1888	May 2				
24	Howell	1888	Apr. 28	Aug. 17	7	5	5-6
25	Jones	1889	May 1			1	8-9
26	Josephine	1890	Apr. 28		3	1	5
27	Kurskaya	1888	" 28	Sept.	4	6	3-5
28	Lawrence	1888	" 28	Oct. 23	5	1	8-9
29	Lawson	1889	" 30				
30	Lucrative	1888	" 29	b m Sept.	6	2	8-9
31	Margaret	1889	" 29	July 16	5	3	4
32	Millett	1891	" 30	Dec. 7	1	5?	
33	Mount Vernon	1888	" 28	b Oct.	5	2	7-8
34	Ogereau	1891	" 28	Oct.-Dec.	12	10	4-5
35	Onondaga	1891	" 29	b Oct.	7	1	7
36	Pitmaston	1891	" 29				
37	Reeder	1890	" 28	m Oct.	8	10	7-8
38	Rostiezer	1888	" 28	Aug. 4	4	2	10
39	Rutter	1893	" 28	m Oct.	10	5	7
40	Seckel	1888	" 28	b m Oct.	3	3	10
41	Sterling	1888	" 29	Aug. 15	4	1	5-6
42	Summer Doyenne	1888	" 29	July 30	2	2	5
43	Victorina	1888	" 28	b Aug.	4	4	4-5
44	Winter Nelis	1888	" 30	Oct. 23	8	1	10

To prevent the depredations of the codling moth (*Carpocapsa pomonella*), a spray of Bordeaux and Paris green was applied on May 11, using three ounces of Paris green in fifty gallons of Bordeaux.

On May 23 pears were again sprayed for codling moth, using one pound of copper sulphate and three ounces of Paris green in 250 gallons of water.

Trees were sprayed the third time for codling moth on July 3 to 7.

Strong tobacco decoction was applied to destroy slugs (*Eriocampa cerasi*) on June 9, again on June 15 to 20, on August 12, and finally on August 21.

Only such varieties are included in the previous table, as have bloomed or fruited during the past season.

NOTES ON VARIETIES.

Angouleme, on free stocks, planted in 1891, has now borne its second crop of well-developed fruit. This may be considered singular, since the variety is reputed to be a tardy bearer on free stocks.

Ansault (Bonne du Puits Ansault), planted in 1889, has borne its third crop of full medium-sized fruit, above medium in quality. It bears young and profusely, requiring severe thinning.

Barry (Patrick), a California seedling and a long keeper, is an early bearer here. The tree is a slow straggling grower. Specimens weigh from four to five ounces. Flesh fine grained, juicy, highly vinous in flavor. It requires special care in keeping to prevent shriveling.

Bartlett, Clapp (Fav.) and Howell are market varieties, too well known to require characterization here.

Bloodgood, Giffard, Rostiezer and Summer Doyenne are early varieties of superior quality, specially desirable for home use.

Bosc is large and excellent for both home use and market.

Coreless, received from Missouri, proves identical with Flemish.

Dana-Hovey, though small, is one of the finest of winter pears. The tree also is vigorous and beautiful.

Duhamel (du Monceau) and Early Duchess (Duchesse Precoce), are recently introduced varieties, showing their first fruits here this year.

Elizabeth (Manning), and Fitzwater also fruit here this year for the first time. So far, the latter lacks vigor. Both are of high quality.

Gakovsk, Kurskaya and Victorina are from Prof. Budd's Russian importations. Though vigorous and productive, they promise little value in comparison with many other well known varieties.

Gray Doyenne is one of the oldest European varieties. Though excellent, it is now rarely planted except by curious amateurs.

Jones, Josephine, Lawson and Millett (this last a comparatively recent importation) have each shown their first fruits here this season, though too few to warrant conclusions respecting them.

Lawrence, winter; Lucrative, autumn; Margaret, summer; and Mount Vernon, Onondaga, Reeder, Rutter, Seckel and Winter Nelis, all ripening this year, in October, are valuable, but too well known to require special characterization.

Ogereau, a comparatively recent European variety, is a showy late autumn and early winter pear, weighing twelve ounces. Planted in 1891, it has now produced its second full crop of fruit.

Sterling is a comparatively old variety of American origin; a very beautiful fruit, well adapted to early marketing, and specially exempt from blight.

APPLES.—(*Pyrus malus*).

Apples, while yet dormant, were on April 13th to 17th treated with the strong solution of copper sulphate, in common with other fruit trees.

Bordeaux mixture with Paris green was applied for codling moth on May 11th to 19th, the treatment having been delayed by high winds.

On May 23d to 27th the treatment was repeated, using one pound of copper sulphate and three ounces of Paris green in 250 gallons of water. This treatment was again applied on June 11th, and a final spray of the same was given on July 3d.

These several treatments appear to have been thoroughly effective against the attacks of fungi, though, possibly consequent upon delayed treatment during windy weather, they were but partially effective against the codling moth.

Tobacco decoction, made by digesting tobacco stems for several hours in cold water sufficient to cover them when slightly weighted, proves to be a specific against aphides. These have been rather persistent this season. In subduing them, this spray was first applied on July 8th to 10th, and again on the 25th.

Only such varieties as have bloomed or fruited this season are included in the following table

Crabs are compared with crabs only, so far as quality is concerned. The word crab, where it appears, is not to be understood as part of the name.

APPLES (*Pyrus malus*).

Number.	Name.	Planted.	Bloomed.	Ripened.	Color—g, green; r, red; s, russet; y, yellow.	Flavor—a, acid; b, sub-acid; s, sweet.	Weight of specimen in ounces.	Productiveness—scale (1–10).	Quality—scale (1–10).
1	August (crab)	1890	Apr. 29	Aug. 10	y r	a	6	1	3–4
2	Babbitt	1890	" 23		y r	b	10	10	5–6
3	Bailey	1888	May 2	Oct.	r	s	10	3	7–8
4	Borovinka	1888	Apr. 29	July 30	y r	b	8	10	6
5	Bough	1888	May 1	" 22	y r	s	10	5	7
6	Bradford	1890	Apr. 30	Nov.	g r	b	5	1	4
7	Buckingham	1892	May 6						
8	Chenango	1888	" 2	July 31	y r	b	8	1	7
9	Clark Orange	1892	" 1						
10	Cogswell	1888		Nov.-Mar.	y r	b	7	1	7–8
11	Colton	1888	Apr. 29	July 11	y r	b	6	10	6
12	Colvert	1892	May 2						
13	Cornell	1890	" 2	Aug. 25	r	b	7	9	5–7
14	Craine	1888	" 2	Dec.	y r	b	4	1	7
15	Cullin	1890	" 1					3	
16	Dartmouth (crab)	1890	Apr. 30	Aug. 8	r	b	3	10	10
17	Dickinson	1889	May 2						
18	Dyer	1888	" 1	Aug. 13	g y	b	6	10	9–10
19	Early Ripe	1891	" 1						
20	Early Strawberry	1888	" 2	Aug. 4			3	2	7
21	Excelsior	1890	Apr. 30	e Aug.	y r	b	6	10	6
22	Fall Pippin	1890	May 4	b Nov.	y r	b	9	1	10
23	Fink	1892	" 2						
24	Flushing	1888	" 2						
25	Gideon Sweet	1896							
26	Gloege	1888	Apr. 30	Nov.-Mar.	y r	b	7	5	4
27	Golden Reinette	1888	May 2	Oct.	r y	b	5	1	4–5
28	Golden Russet (N. Y.)	1888	Apr. 30	Dec.-Mar.	y s	b	6	10	10
29	Greenville	1895							
30	Grindstone	1888	May 1	Dec.-May	g y	b	6	1	3
31	Grosh	1890	Apr. 30	b Sept.	y r	b	6	6	7–8
32	Hargrove	1892	" 29						
33	Hawley	1888	May 2	m Sept.	y	b	11	1	8–9
34	Hubbardston	1888	" 2	Nov.-Feb.	y r	b	9	4	8–9
35	Indian	1892	" 2	b m Sept.	y r	b	9	10	4–5
36	Iowa Keeper	1891	" 2	Dec.	g r	b	6	3	4–5
37	Jefferis	1888	Apr. 30	Aug. 12	y r	b	6	5	9
38	Jelly	1890	" 29	Sept. 16	y r	a	2	8	4
39	Jersey Sweet	1888	May 2	e Aug.	y r	s	6	5	8
40	Jonathan	1888	" 4	Nov.-Mar.	y r	b	7	10	9–10
41	Keswick	1888	Apr. 30	Aug.	y	a	6	10	10
42	Kirkland	1890	May 1					2	
43	Longfield	1892	Apr. 29	Sept. 11	y r	b	7	10	5
44	Lou	1890	" 30	m July	y r	b	5	10	5
45	Louise	1890	May 4					4	
46	Lowell	1890	" 1	Aug. 15	y	b	10	10	6–7
47	Magog	1890	" 1					5	
48	Maiden Blush	1885	" 2						
49	Martha	1890	" 1					1	
50	Mason Orange	1890		Nov.	y	b	8	1	5–6
51	McLellan	1888	May 7						
52	Minkler	1892	Apr. 29	Jan.-Mar.	g y r	b	9	5	6–8
53	Morris (Red)	1890	" 6						
54	Northfield	1890	May 2	Nov.-Dec.	y r	b	7	1	5
55	North Star (crab)	1891	Apr. 29	July 22	r y	a	2	1	6
56	No. 2 New	1890	" 29	m Aug.	g y r	b	6	10	6
57	Oakland	1888	" 30	Oct. 23	y r	b	6	10	7–8
58	October	1890	" 29	Aug. 15	r	b	6	9	5
59	Oldenburg	1892	" 29	" 15	y r	a	8	10	4–5
60	Ontario	1890	May 2	Jan.	y r	b	9	3	6

APPLES (*Pyrus malus.*)—CONCLUDED.

Number.	Name.	Planted.	Bloomed.	Ripened.	Color—g, green; r, red; s, russet; y, yellow.	Flavor—a, acid; b, sub-acid; s, sweet.	Weight of specimen in ounces.	Productiveness—scale (1 to 10).	Quality—scale (1 to 10).
61	Pawpaw	1888	May 4	......	......	......	......	......	......
62	Peter	1890	" 1	Aug. 6	y r	b	5	6	3-4
63	Pewaukee	1892	" 2	......	......	......	......	......	......
64	Pickett	1888	" 4	Dec.	y r	b	6	1	4-5
65	Pine Stump	1894	Apr. 29	......	......	......	......	......	......
66	Primate	1888	" 29	July 13	y r	b	8	10	8
67	Pryor Red Seedling	1888	May 2	......	......	......	......	......	......
68	Quaker (crab)	1891	Apr. 29	Oct.	y r	b	8	1	6-7
69	Quince (Cole)	1892	May 1	Aug. 8	y	b	7	1	......
70	Ramsdell Sweet	1890	" 1	......	......	......	......	2	......
71	Red Aport	1888	" 2	......	......	......	......	2	......
72	Red Astrachan	1888	Apr. 30	July 18	r y	b	6	10	8-9
73	Red Canada	1888	May 4	Jan.-May	r y	b	6	1	9-9
74	Red Dettmer	1888	Apr. 29	b Sept.	y r	b	8	1	3-4
75	Red Russet	1890	May 1	......	......	......	......	1	......
76	Rhode Island	1888	" 2	Nov.-Mar.	g y	b	11	1	8-9
77	Ronk	1888	Apr. 30	Nov.-Dec.	g y r	b	8	1	7
78	Rosenhager	1888	" 29	Sept.-Oct.	g r	a	11	10	5-6
79	Roxbury	1888	" 30	Jan.-June	g s	b	6	10	4-5
80	Salome	1888	May 5	......	......	......	......	......	......
81	Scarlet Cranberry	1891	Apr. 30	Dec.	g r	b	8	1	4
82	Scott Winter	1892	May 1	......	......	......	......	......	......
83	Sheriff	1891	" 2	Dec.	g r	b	6	1	7
84	Smokehouse	1893	" 2	......	......	......	......	......	......
85	Stark	1888	Apr. 29	Jan.-May	g y r	b	8	4	4-5
86	Stuart	1890	May 1	......	......	......	......	8	......
87	Summer Pearmain	1888	Apr. 29	Aug. 17	y r	b	5	10	10
88	Summer Rose	1892	" 29	July 30	y r	b	4	1	9-10
89	Thaler ?	1888	" 30	" 10	y r	b	5	1	5
90	Thornton	1892	May 1	Oct.-Nov.	g y r	b	7	9	5
91	Titovka	1888	Apr. 29	July 29	g y r	b	8	9	4-5
92	Tolman	1888	May 4	Nov.-Apr.	y	s	6	1	10
93	Transcendent	1893	Apr. 29	Aug. 16	y r	a	2	10	5-6
94	Wagener	1893	" 20	Nov.-Mar.	r y	b	6	10	8-9
95	Washington (Stry.)	1890	" 30	Aug. 17	y r	b	11	8	7
96	Water	1890	May 1	Oct. 23	y r	b	5	10	5
97	Wealthy	1890	" 1	e Aug.	y r	b	6	10	6
98	Whinery	1890	" 1	......	......	......	......	......	......
99	Whitney	1890	" 1	e Aug.	r y	b	4	1	6
100	Winter Streifling	1888	Apr. 29	Aug. 26	y r	a	6	10	4-5
101	Yellow Transparent	1888	May 1	July 13	y	a	5	10	3-4
102	Zolotoreff	1890	Apr. 30	July 30	y r	b	9	1	3-4

NOTES ON VARIETIES.

August, Excelsior, Gideon Sweet, Jelly, Lou, Martha, No. 2 New, October, Peter and Wealthy are seedlings originated by Peter M. Gideon, of Minnesota. All are alleged to have sprung, either directly or indirectly, from the crab (Pyrus baccata), and afford, in tree or fruit (one or both), more or less indication of such parentage, excepting only the Wealthy, which affords no evidence of crab parentage, beyond the fact that it appears to be fairly hardy, in many portions of the Northwest. It is a fairly good dessert fruit, while the others are mainly culinary varieties.

Borovinka is very much like Oldenburg, and, for all practical purposes, may be considered identical with it. This, with Golden Reinette, Longfield. Red Aport (much like Alexander), Red Dettmer, Rosenhager, Thaler

(identity doubtful), Titovka, Winter Streifling, Yellow Transparent and Zolotoreff, are all importations from northeastern Europe for trial in the "cold north." Few if any of them seem likely to prove valuable in lower Michigan. Red Astrachan, Oldenburg and Alexander, although long and favorably known in this country, came originally from the same region.

Bough (Sweet Bough or Large Yellow Bough, of the books), has but the one serious fault, that it lacks productiveness.

Chenango (long known about Grand Rapids as Jackson), though easily bruised on account of its delicate texture, is an admirable variety, at least for home use.

Cogswell (an old Connecticut variety), is an excellent longkeeper, though, unfortunately, a rather tardy bearer.

Colton has now borne two heavy successive crops, of fine size and fair quality. It promises well as a very early market variety.

Cornell (Fancy) is an old Pennsylvania variety, adapted to home use rather than the market.

Dartmouth is a large and exceedingly beautiful crab, of fine quality and the tree a good grower and bearer.

Dyer, though only a moderate grower, is a heavy bearer and the fruit, though not very attractive in appearance, is of high quality.

Early Strawberry, though not large, is very beautiful, of excellent quality, and the tree of fine habit.

Fall Pippin, though large, and of superior quality, is true to its reputation as a tardy and thin bearer. The fruit also is much inclined to scab; which however may be mainly prevented by the use of fungicides.

Flushing (Spitzenburg) is prized, in some localities, as a market apple. Some years since, it was widely distributed from a Wayne county nursery, as Red Canada or Steele's Red Winter.

Golden Russet (N. Y.) is commonly known as simply Golden Russet. When well grown and not allowed to shrivel from too free exposure, it has few superiors as a profitable market fruit.

Greenville was originally named *Downing's Winter Maiden's Blush.* This very long and otherwise objectionable name is now changed as above. It has not yet fruited here.

Hawley is very large, beautiful and excellent, but the fruit deteriorates quickly after ripening.

Jefferis is beautiful and excellent. No family orchard or village or city fruit garden should be without it.

Jersey Sweet is the prince among baking sweet apples, for early September.

Jonathan deserves far more attention than it has received thus far, in Michigan, as an excellent winter apple, for both the home plantation and the market. It is popular throughout the west.

Louise, a Canadian seedling, named for Princess Louise, of England. In Yankee land it loses its aristocratic prefix. It is a beautiful and promising fruit.

Lowell is large, productive and profitable.

McLellan is an excellent and very beautiful fruit, and the tree vigorous and productive.

Minkler is old, an early bearer and productive. It is a western variety.

North Star and Quaker are crabs, originating at the Northwest and claimed to be hardy enough for the extreme north. Both are culinary varieties.

Ontario is a seedling by the late Charles Arnold, of Ontario, and is already quite popular in that province.

Ramsdell Sweet (English Sweet) is among the very best dessert and culinary sweet apples for late autumn and early winter.

Red Canada, so long erroneously known throughout Michigan as Steele's Red Winter, is, more recently, losing its former popularity, on account of its feeble habit of growth, as well as increased liability to the attacks of fungi.

Red Russet, though usually more or less russeted, is much like Baldwin in both tree and fruit, though of superior flavor, and perhaps less productive.

Rhode Island is the old well known Greening. There are now so many *Greenings* that the word is no longer distinctive, and is omitted from this in the interest of brevity.

Roxbury, though an excellent longkeeper, is now rarely planted, doubtless largely on account of its tendency to shrivel, when kept in a free exposure, as well as on account of the very spreading habit and deficient hardiness of the tree.

Sheriff comes to us from Nebraska, where it seems to be valued as a hardy longkeeper. It is but partially tested here.

Stark has more or less reputation in Michigan, as a vigorous, hardy and productive longkeeper of only moderate quality.

Summer Pearmain and Summer Rose are early autumn and late summer varieties respectively. Each stands unrivaled in its season for great beauty and superior flavor.

Tolman is one of our most popular baking sweet apples. Recent investigation determines that the correct spelling of the name is as here given.

Transcendent (a quite too sensational name), is probably the most popular of the crabs among Michigan planters.

Wagener is valued for early bearing, great productiveness, and high quality. The tree is usually short lived for such reason.

Washington (Strawberry), though large and beautiful, it is not of high quality. The tree is vigorous and an early bearer.

Whitney (20) has the small size and the long slender stem of the crab, though it differs radically from them in texture and flavor. The tree shows few, if any, of the crab peculiarities, though possessing much of their hardiness.

QUINCES.—(*Cydonia.*)

Prior to the use of Bordeaux mixture at this substation, as a fungicide, the fruit, and occasionally the young growths of the quince, were occasionally attacked by what is usually designated as "Red rust" (perhaps the Gymnosporangium of the Mycologists), which was treated by cutting away and burning.

The foliage, also, was frequently attacked by leaf blight (*Entomosporium maculatum*), a disease common to both this and the pear.

With the free use of Bordeaux, and more recently of a simple solution of copper sulphate, both have disappeared, and the quince has been wholly free from the attacks of fungi, with the exception of an occasional slight visitation of twig blight, akin to that of the apple and pear, which has only proved serious in the case of a single plant of Champion.

No visitations have been discovered of the borers so frequently troublesome with the quince and the apple, which exemption may perhaps be attributable to low branching and the consequent shading of the collars of the trees, at which points such attacks are usually made, and probably in part, to maintaining them in vigorous condition.

The only troublesome insect has been the slug (*Eriocampa cerasi*), which has been unusually persistent this season. Against this insect the decoction of tobacco stems has proved thoroughly effective. It has been applied from time to time as fresh colonies appeared. The first application was made June 9, and the final one August 21.

The crop of this fruit, this season, has been a comparatively light one.

QUINCES.—(*Cydonia.*)

No	Name.	Planted.	Bloomed.	Ripened.
1	Alaska	1891	May 7	m Oct.
2	Angers	1890		
3	Bourgeat	1895	May 7	
4	Champion	1888	May 6	m Oct.
5	Fuller	1891	May 7	
6	Hong Kong	1888		
7	Meech	1888	May 7	e Sept.
8	Missouri	1890	May 7	e Sept.
9	Orange	1888	May 6	m e Sept.
10	Rea	1888	May 6	m e Sept.
11	Van Deman	1895		

NOTES ON VARIETIES.

For the reason that the partially tested varieties may be supposed not to have fully manifested their peculiarities, the tabulation of these particulars is deferred to await more perfect development.

Alaska and Fuller have not yet received a sufficient trial here, but so far they can scarcely be said to be promising.

Angers and Bourgeat are vigorous, upright growers, but neither has yet fruited here.

Champion is vigorous, prolific and an early bearer, but does not always fully mature within our seasons.

Hong Kong, though planted here in 1888, has not yet even bloomed, though it is apparently hardy here.

Meech is a good grower, ripening rather late. Its value, compared with several others may be regarded as doubtful.

Missouri, Orange and Rea are practically very nearly identical.

Van Deman is a quite recent variety, not yet fruited here.

Varieties, so far as fruited, vary somewhat in size, and perhaps slightly in quality, as well as in season; but the old Orange or Apple quince can scarcely yet be said to be even equaled in value for any purpose, unless, possibly, by some of those not yet fully tested.

NUTS.

ALMONDS.—(*Amygdalus communis.*)

Of these Hard Shell (Luelling), and Soft Shell (unnamed), are on trial, but have, so far, failed to fruit, and have not even bloomed this season.

CHESTNUTS.—(*Castanea.*)

Comfort, planted only last year, has, this season, made a very vigorous growth, but has not yet bloomed.

Hathaway (a seedling from the large native variety originated by the late B. Hathaway), has again shown catkins, but no fruit.

Japan Giant, planted in 1895, has, this season, produced burs, but the nuts proved abortive.

Numbo, planted in 1892, has, this season, produced several abortive burs. The catkins and germs for next season's fruit developed in August and September, quite too late to mature, doubtless at the expense of the next year's crop, and quite probably with increased danger of injury during the coming winter.

Paragon, although severely thinned, still fruited heavily last year. This year's crop is consequently a light one.

Spanish (seedling), produced a large crop of burs, but the nuts were small, and nearly all were abortive.

FILBERTS AND HAZELNUTS.—(*Corylus.*)

Cosford Thin Shell Filbert, planted in 1895, is scarcely yet well established and, of course, has not yet fruited.

Hazelnut plants (unnamed), were received from the Division of Pomology, at Washington, D. C., in 1892. They have grown vigorously and continue healthy, but have not yet fruited.

Tree Hazelnuts were recently discovered in the state of Washington, of (if recollection is correct) seven or eight inches diameter. Plants were received here for trial in 1893, but failed to make satisfactory growth, and are now dead.

Kentish Cob Filbert, planted here in 1892, has, for several years, produced catkins, but has not, so far, shown fruit. It has withstood our winters so far, with little if any injury.

PECANS.—(*Carya olivæformis.*)

Seedling (from Iowa seed), planted in 1890, has stood uninjured, without shelter or protection of any kind. It has not yet shown fruit.

Stuart Pecan, grown from Texas seed, planted here in 1894. The plants have been earthed up during the past winters, and yet have killed to the surface in winter, starting from below each spring. This year they have been sheathed with straw, and earthed up still more heavily, with the faint hope that age may increase their hardiness.

WALNUTS.—*Juglans.*))

Japan Walnut (*Juglans Seiboldii*). This bloomed about the beginning of July, and produced a large crop of nuts, which matured slightly in advance of the first hard frost. The nuts are, in flavor and general appearance, much like our native butternut, though smaller and less roughened, and usually in clusters of nearly or quite a dozen each.

Persian (*Juglans regia*), is hardy here, having been planted in 1890, and stood thus far uninjured, though unprotected. It has made only moderate growths, and has not yet fruited.

Præparturiens (*J. regia*), is a dwarf variety of the Persian, planted in 1890. It has not yet fruited.

Thin Shell (*J. regia?*), was planted in 1894. It appears to be hardy, but has not shown fruit.

APRICOTS.—(*Armeniaca vulgaris*).

The Russian apricots, so called, which had been on trial here since 1888, have been, so far, entirely unproductive and obviously unadapted to this climate and several having died, apparently from lack of hardiness, have now been rooted out.

Harris, a recent variety, originated in central New York and commended by prominent growers there, is the only variety of this fruit retained here This may be expected to fruit during the coming year.

MULBERRIES.—(*Morus*).

Downing is a very vigorous variety, and the fruit of good size and quality, but the tree lacks hardiness for this climate.

Hicks is a southern variety, of fair quality, but of small size as grown here. Though hardy here, it is apparently more successful farther south.

New American is vigorous, hardy and very productive. It is by far the most desirable variety for this climate yet tested here.

Russian is hardy, vigorous and productive; the tree is very spreading, even drooping. The fruit, though very abundant, is small and worthless.

Teas' Weeping is one of the very finest trees of its class when grafted upon an upright stock.

NECTARINES.—(*Persica vulgaris*).

Of this class of fruits there are but two varieties upon the premises, neither of which has shown fruit this season.

ASPARAGUS.—(*Asparagus officinalis*).

Palmetto, which, in previous years, proved superior to either Barr or Conover has, this season, shown little superiority over either.

Columbian (Mammoth White), is as indicated by its name, a peculiar light-greenish white variety, very much like Palmetto, when at its best; perchance a slight improvement. This, however, may be due to the greater vigor of young plants.

RHUBARB.—(*Rheum rhaponticum*).

Of the half-dozen varieties of rhubarb thus far tested, none of the older varieties have proved superior, in either earliness, productiveness or quality to the Linnæus.

Bailey, a more recent seedling, received from S. S. Bailey, of Kent county, Michigan, has unusually dark green foliage, of large size, productive and of excellent flavor. It is eminently worthy of trial.

SOUTH HAVEN, MICH.,
January 5, 1897. T. T. LYON.

VEGETABLES, OLD AND NEW.

BY L. R. TAFT, H. P. GLADDEN AND M. L. DEAN.

Bulletin No. 144.—Horticultural Department.

CONTENTS.

The following notes give the results of our trials of several hundred varieties of vegetables grown in 1896. The list includes nearly all of the novelties advertised by the various seedsmen, and many of the older sorts for comparison:

The seeds used in our tests were obtained from the following seedsmen:

Francis Brill, Hempsted, L. I.; H. W. Buckbee & Co., Rockford, Ill.; Robert Buist & Co., Philadelphia, Pa.; W. Atlee Burpee & Co., Philadelphia, Pa.; John Lewis Childs, Floral Park, N. Y.; Department of Agriculture, Washington, D. C.; Henry A. Dreer, Philadelphia, Pa.; L. J. Farmer, Pulaski, N. Y.; D. M. Ferry & Co., Detroit, Mich.; James J. H. Gregory & Son, Marblehead, Mass.; Peter Henderson & Co., New York; H. D. Hobbs, Williamston, Mich.; Johnson & Stokes, Philadelphia, Pa.; John W. King, Coggeshall, Eng.; D. Landreth & Sons, Philadelphia, Pa.; Wm. Henry Maule, Philadelphia, Pa.; W. A. Manda, South Orange, N. J.; Delano Moore, Presque Isle, Me.; Northrup, Braslan, Goodwin Co., Minneapolis, Minn.; Richard Nott, Burlington, Vt.; Oregon Experiment Station, Corvallis, Oregon; John A. Salzer Seed Co., La Crosse, Wis.; J. M. Thorburn & Co., New York; J C. Vaughan & Co., Chicago, Ill.

BUSH BEANS.

Thirty-five varieties of bush beans were planted May 25 and 26. Most of the varieties made a good stand of plants, and bore a large crop of pods. The wet season made the plants and pods rust badly. Little, if any, difference was noticeable as to amount of rust on one variety as compared with another. The rust attacked the pods after the time they would be gathered for string beans, so little injury was done. In the plat of varieties each sort was thinned to thirty stalks, four inches apart. The last column in the table below gives the average weight of pods, computed from the thirty plants, for each sort grown. The pods were gathered when at the fullest development for string beans.

Variety.	Seedsmen.	Date bloom.	Date edible.	Weight of green pods in ounces for one plant.
Blue Podded Butter	Vaughan	July 10	July 21	3.083
Cylinder Black Wax	Henderson	" 8	" 19	4.083
Davis Wax	Ferry	" 8	" 18	3.333
Detroit Wax	Ferry	" 10	" 21	3.666
Dwarf Horticultural	Ferry	" 7	" 24	3.833
Dwarf Wax No 40	Burpee	" 13	" 27	4.833
Flageolet Victoria	Henderson	" 13	" 21	9.166
Flageolet Violet Wax	Henderson	" 7	" 21	6.666
Flageolet Violet Wax	U. S. Dept. Ag.	" 10	" 21	6.333
Fuller Black Wax	Gregory	" 10	" 22	2.833
Greenell	Gregory	" 10	" 21	5.833
Improved Tree	U. S. Dept. Ag.	" 21	Aug. 4	4.583
Imperial Wax	Vaughan	" 10	July 21	5.166
Keeney's Golden Wax	Burpee	" 10	" 21	6.666
King of the Wax	Dreer	" 10	" 24	5.166
Prolific German Wax	M. A. C.	" 10	" 19	3.75
Red Valentine—Earliest	Henderson	" 10	" 14	5.833
Red Valentine—Extra Early	Landreth	" 10	" 14	6.266
Refugee Wax	Henderson	" 10	" 21	5.333
Roger's Lima Wax	Johnson & Stokes	" 10	" 27	4.000
Saddle Back Wax	Burpee	" 13	" 21	4.500
Stringless Green Pod	Burpee	" 10	" 24	6.666
Thorburn Prolific Market	Thorburn	" 10	" 24	3.416
Valentine Wax	Henderson	" 10	" 14	5.166
Wardwell's Kidney Wax	Ferry	" 10	" 21	6.166
Warren	Vaughan	" 10	" 21	7.416
Yosemite Wax	Vaughan	" 10	" 24	2.666
Japan No. 1	Oregon Ag. Col.	" 10	" 24	3.416
Japan No. 3	Oregon Ag. Col.	" 21	Aug. 12	6.750
California Pea	Hobbs	" 23	" 13	....
California Pea Lady Washington	Hobbs	" 23	" 15	....

NOTES ON VARIETIES.

The following are sorts of recent introduction:

Dwarf Wax No. 40, W. Atlee Burpee & Co., Philadelphia. Plants very vigorous and branching; foliage large, light green, with yellowish tinge. Pods form in clusters, well covered with leaves; they are broad and flat, four to five inches long, curved; color, light waxy yellow, tinged

with green, quality of the best and stringless. It is somewhat late in maturing, but the good quality of the pods, length of season, with the large crop borne, make this a very desirable sort for the garden.

Roger's Lima Wax, Johnson & Stokes, appears identical with above.

Fuller Black Wax, James J. H. Gregory & Son, Marblehead, Mass. Differs from Black Wax in having pods that are a little longer, a darker yellow and perhaps less stringy. The plants were less productive than German Wax and the variety as grown here has little to recommend it over that well known sort.

Keeney's Golden Wax, Burpee. A very strong grower, inclining to climb. Foliage large, wrinkled and light green in color. Pods four to six inches long, broad, becoming nearly round as they mature and of a rich yellow color; the quality is of the best and they are stringless for a long time. The plants are very productive, bearing the crop all along the stem, thus also extending the season. For productiveness, length of season and good quality of the pods, this variety has few superiors.

King of the Wax, Henry A. Dreer, Phila. Plant growth strong and compact. The pods are four to five inches long, thick and of a rich yellow color. Valuable for thick tender flesh of good quality and length of season. Productive.

Imperial Wax, J. C. Vaughan & Co., Chicago. Plants of vigorous, rather upright growth, branching very little. Pods five to six inches long, broad and of fine quality; color, a bright waxy yellow; remain in edible condition but a short time. Plants are very productive. Season, medium early. An excellent sort.

Valentine Wax, Peter Henderson & Co., New York. This variety, in plant growth, shape of pod and in appearance of bean is similar to the common Red Valentine. The pods, however, are golden yellow in color, of best quality and free from stringiness. The plants are very productive and the season is early, a valuable acquisition to the wax sorts.

Japan No. 1 and No. 3, Oregon Agricultural College. The seed of these varieties was sent from Japan. The varieties are late in maturing. The plants are productive but the quality of the pods is not good.

California Pea, H. D. Hobbs, Williamston, Mich. Plants very productive and the beans are of the best quality. Excellent sorts of the small pea bean class.

Of the older and better known varieties, *Cylinder Black Wax*, *Flageolet Victoria* and *Saddle-back Wax*, among the yellow-podded sorts, and *Red Valentine* and *Stringless Green Pod*, among the green-podded, were sorts of high excellence.

SUMMARY OF VARIETIES.

The following among wax sorts are recommended for general culture, *Valentine Wax*, *Keeney's Golden Wax*, *Cylinder Black Wax* and *Flageolet Victoria*. Green-podded sorts, *Red Valentine* and *Stringless Green Pod*. *Dwarf Horticultural* is an excellent shell bean.

BEETS.

Variety.	Seedsman.	Date edible.	Remarks.
Columbia	Burpee	July 10	Five to six inches diameter, round, regular, rich color.
Crimson Chief	Johnson & Stokes	" 20	Four to five inches diameter, dark crimson, hard and firm, quality not best.
Detroit Dark Red	Ferry	" 14	Excellent specimens of the class; good form, color and quality.
Dirigo Blood Turnip	U. S. Dept. Agr.	" 16	Dark flesh, firm and sweet, not crisp or tender, form irregular.
Dobbie's New Purple	Dobbie & Co.	" 20	Long Blood class: good form and color, watery, quality not best.
Electric	Henderson	June 24	Regular form, color light, not of high quality.
Landreth's Very Early	Landreth	" 28	Fine form, flesh nearly white, color against it.
Long Blood Red	Landreth	Aug. 5	Excellent specimens of class.
Shull's Model Blood Turnip	Buist	July 10	Perfect form, flesh very firm, crisp, sweet and tender, bright crimson.
Stinson Dark	Burpee	" 10	Good form, very dark, firm, flesh of good quality.
Surprise	Johnson & Stokes	June 15	Not of regular form, flesh white, sweet, not very solid or crisp.
Egyptian Turnip Rooted	John S. King	" 20	An improvement over old Egyptian.

The varieties of beets were planted May 18. When the roots were from two and one-half to three inches in diameter they were taken to be of edible size, and the dates given in the table above.

Surprise was earliest to mature, but the color and quality are not of the best. Its earliness, however, is a strong point in its favor.

Egyptian Turnip Rooted. John S. King, England. Early.

It seems to be an improvement in form, firmness and quality over old type of Egyptian.

Columbia is a little earlier than the Blood Turnip sorts, and equal to them in form and quality. A very desirable sort.

Shull's Model Blood Turnip was perfect in form, very firm flesh which was crisp and tender. Its fine form, quality and earliness make it one of the best of the Blood Turnip beets.

Long Blood is an excellent sort for winter use.

Egyptian or *Eclipse* for first early, *Bassano* for greens, *Shull's Model Blood Turnip*, or any of the Blood Turnip class with *Half-long* or *Long Blood* would give an excellent list of varieties for the garden or for market.

CABBAGE.

Sixty-eight varieties were selected for the test in cabbages.

The seed of the early sorts was sown in small boxes in the forcing house, March 16; the medium varieties were sown April 23, and the late ones May 19.

As soon as the third leaf appeared on the seedlings they were pricked out into flats and allowed to grow until the time of transplanting in the field, when twenty-five plants of each variety were set in rows three and one-half feet apart.

The early varieties were put in the field May 18, the medium June 11, and the late ones July 3.

The early sorts were watered once by surface irrigation when the heads were about half grown, but the following rains furnished sufficient moisture to mature the crop. The early and medium varieties developed large and solid heads, but the wet weather retarded the growth of the late varieties and many failed to head, hence comparisons were not put in the table.

They were planted in rows three and one-half feet apart, each plant having a space of twenty inches in the row.

CABBAGE.

Number.	Variety.	Seedsman.	Season.	Date. First mature head.	Date. Market maturity.	No. days from transplanting to maturity.	Number plants headed.	Total weight.	Average weight.
1	All Head	Burpee	Early	July 20	Aug. 5	79	19	57	3
2	Brunswick Improved	Vaughan	"	" 29	" 6	80	13	26	2
3	Bullock Heart	Landreth	"	" 17	" 3	77	20	66	3.3
4	Dwarf Flat Dutch	Landreth	"	" 20	" 2	76	9	18	2.
5	Earliest	Johnson & Stokes	"	" 20	" 3	77	18	60	3.3
6	Etampes	Ferry	"	" 16	" 3	77	21	57	2.71
7	Express	Vaughan	"	" 17	" 3	77	16	455	2.82
8	French Ox Head	Henderson	"	" 28	" 5	79	9	21	2.3
9	Hend. Early Spring	Henderson	"	" 18	" 3	77	12	42	3.5
10	Henderson Early Summer	Henderson	"	" 28	" 6	80	15	36	2.4
11	Landreth Earliest Market	Landreth	"	" 21	" 3	76	15	49	3.26
12	Bloomsdale	Landreth	"	" 28	" 6	80	10	28	2.8
13	Reedland Drumhead	Landreth	"	" 23	" 6	80	19	66	3.47
14	Reynolds	Gregory	"	" 24	" 6	80	6	17	2.87
15	Salzer's Lightning	Salzer	"	" 7	" 3	77	17	70	4.11
16	Scotland Early	Burpee	"	" 25	" 6	80	13	32	2.46
17	St. John's Drumhead	Henderson	"	" 24	" 6	80	11	30	2.82
18	Summer Flat Head	Landreth	"	" 22	" 5	79	8	28	3.5
19	Wakefield, Early Jersey	Vaughan	"	" 20	" 5	79	22	70	3.18
20	Wakefield, Early Selected	Vaughan	"	" 14	" 3	77	17	70	4.11
21	Wakefield, Charleston	Henderson	"	" 21	" 5	79	21	78	3.71
22	Wakefield, Large Jersey	Vaughan	"	" 17	" 5	79	16	55	3.11
23	Wakefield, Prize	Maule	"	" 18	" 5	79	20	74	3.7
24	Wakefield, Washington	Northrup, Braslan, Goodwin & Co.	"	" 17	" 5	79	16	64	4
25	Winnigstadt	Ferry	"	" 22	" 6	80	11	39	3.54
26	Wonderful	Johnson & Stokes	"	" 17	" 3	77	15	56	3.73
27	York Early	Henderson	"	" 29	" 10	81	9	18	2
28	York Early	J. Kling	"	" 29	" 10	81	16	56	3.5
28½	All The Year Round	Landreth	Medium	Aug. 15	" 25	75	15	106	7.06
29	All The Year Round	Johnson & Stokes	"	" 10	" 20	70	21	84	4
30	Braunschweiger	Salzer	"	" 18	" 22	78	12	71	5.91
31	Eclipse	Maule	"	" 28	Sept. 1	81	5	27	5.4
32	Long Island	Brill	"	" 10	Aug. 20	70	21	172	8.19
33	Lupton	Burpee	"	" 17	" 28	78	23	161	7
34	Lupton	Maule	"	" 17	" 28	78	15	165	11
35	Midsummer	Maule	"	" 18	" 25	75	23	184	8
36	Salzer's Ideal	Salzer	"	" 18	" 26	76	20	146	7.3
37	Short Stem	Henderson	"	" 16	" 24	74	19	157	8.26
38	Succession	Henderson	"	" 10	" 20	70	17	133	7.81
39	Vandergaw	Vaughan	"	" 30	Sept. 1	81	21	202	9.61
40	World Beater	Burpee	"	" 19	" 1	81	23	110	4.74

The table includes many kinds that have been on trial for several years, some of which show special value and were grown for the purpose of comparison.

Among the standard early varieties are Salzer's Lightning, the Wakefields, Henderson's Early Summer, Bloomsdale Early Market and Early Flat Dutch. All are of value for the production of early solid heads of good size, shape and quality.

For medium varieties there are none better than Succession, All Seasons, Reynolds, and the Early Drumheads, some of which produce heads equal in size and quality to some of the winter varieties.

The Drumheads, Flat Dutch and Rock Heads stand at the head as winter cabbages in size, firmness, flavor and keeping qualities.

NOTES ON VARIETIES.

The following notes are given on some of the newer varieties that appear to be of merit:

Early.

Bullock Heart, from Landreth, was one of the first to develop mature heads. The plants are small; stems short and stout; foliage, light green and grows many superfluous leaves. Outer leaves are smooth, thick, erect, glazed; head conical, very solid. The type is similar to that of Wakefield and it is a valuable sort, being a strong, quick grower.

French Ox Head, from Henderson, is a variety maturing a little later than Brunswick Improved; heads were small, soft and not true to any type.

Henderson's Early Spring is a valuable early sort, of the type of Henderson's Early Summer, but a little smaller. The plants are small; stem, short and stout; leaves, dark green, oval, smooth, a little glazed and few in number. Heads are of medium size, flat, round and hard.

Reedland Drumhead.—Landreth. The plants are large, strong growers heavily covered with white bloom. It is a short stemmed, flat headed second early sort; heads are surrounded with much superfluous foliage, but are very hard and compact. True to type.

Scotland Early, from Burpee, is a variety that resembles the Wakefield but is not as desirable. The plants were strong; leaves large, oval, with undulate border; bloom, thin; heads of fair size, true to type, but not very hard, and surrounded with a large amount of superfluous foliage.

Summer Flat Head, from Landreth. Not true to type; appears to be badly mixed in the seed; some good heads but it showed no distinct type as to growth, size, shape or color.

Prize and *Washington Wakefields*, from Maule and Northrup, Braslan and Goodwin, are much alike. They are of the type of the Early Jersey Wakefield, but seem to be a few days later. Plants of medium size; stem, short and stout; leaves, small, dark in color, oval or spoon shaped; heads conical and very solid, with very few surplus leaves. Both are valuable early varieties, being strong growers and sure headers.

Wonderful, from Johnson & Stokes. The plants are very small, with short, slim stems; foliage compact, smooth, dark green and numerous outside leaves; heads, conical, good size, but rather loose. Its special value as an early sort is that it can be grown very close and develops rapidly.

Medium Varieties.

Among the medium varieties, those of special value are as follows:

All the Year Round, from Landreth. This cabbage is about ten days later than the Early Drumhead varieties. Plants are medium size; stem, short and strong; heads, very solid, large and flat; leaves, dark blue, very thick and leathery, but no amount of extra foliage. As the name might indicate, it is a valuable medium or late variety.

Braunschweiger (Salzer), is one of the leading varieties for pickling. The heads are very large, compact, tender and juicy; stem, short and stout; foliage, light green with purple border. It has more superfluous leaves than *All the Year Round*, and is a little glazed.

Long Island, from Brill, resembles the *Lupton* but is not true to type, hence of no special value.

Lupton, from Burpee, was originated in 1888 by J. M. Lupton, one of the most successful cabbage growers on Long Island. The plants are large; heads, thick, flat, hard, crisp and juicy, and are nearly covered by the outside leaves overlapping them. The leaves are of dark bluish green color with purple border, and well filled to the union with the stem. A valuable medium variety for its size of heads, vigor of plants and general high qualities.

Midsummer, from Maule's seed house, developed the largest per cent of solid heads of any variety in the test. In shape, form and type it resembles *All the Year Round*. The plants were large and vigorous, developing enormous heads that were solid, white, crisp and juicy; stem short and stout; foliage thick, light green with white bloom, growing but a very few outside leaves. This being such a sure header, it promises to be of value to the commercial gardener.

Salzer's Ideal, Salzer, grows a symmetrical flat shaped head, and is uniform in size. The heads are solid, crisp, on a short stem, well covered with light green foliage tinted with white bloom. The heads have very few extra leaves and are not as large as Lupton.

Short Stem, Henderson's, is a variety that is true to type and a valuable cabbage for medium or late use. It grows a little smaller than *Midsummer* but is a sure header and identical with it in quality.

Succession is one of the standard varieties and showed a large per cent of developed heads. It is about two weeks later than the *Early Summer* and is all its name implies. The heads are large, flat, thick, very solid and crisp; stems short and stout; foliage medium light with blue-white bloom. True to type and valuable for a medium or late crop.

World Beater, Burpee's, stands with *Midsummer* and *Succession* for per cent of heads matured. The foliage is broad, compact, dark green with brown tints; very true to type, developing firm, crisp heads of fine quality.

Late Varieties.

Market Gardener's Flat Dutch, Landreth, grows a large, vigorous plant with a short, stout stalk. The foliage is compact, medium, dark green with red and purple border; heads large, broad, flat, thick and solid, encased by the leaves overlapping each other. True to type and a desirable variety.

Northrup, Braslan, Goodwin and Company's *One Hundred Weight*, and Johnson and Stokes' *Rock Head* are identical, true to type, and developed

a good per cent of heads, the same shape and quality as *Flat Dutch*, but not as valuable, lacking in size.

Red Drumhead, from Ferry & Co., of Detroit. The principal value of this variety is its shipping qualities. It is a vigorous grower, producing round, hard heads; foliage, thick, red, with white bloom. A valuable sort for market gardeners owing to its vigor, hardiness, size and weight.

Two varieties of *Netted Savoy*, from Henderson and Johnson & Stokes, were of the same type and growth. The plants were of medium size, short stem and vigorous growers; heads solid, compact and elliptical in form; foliage yellow, with green tint. Not of special value, although by some they are admired on account of their delicate flavor.

Champion Drumhead, J. Kling, Essex, England. The Drumheads are the largest growing varieties of cabbage, producing large, broad, deep, hard heads of high quality and should be grown in every garden for a winter sort, as they are sure headers and good keepers.

The varieties of Chinese and Siberian cabbage grown proved to be different kinds of mustard and were of no value.

KALE AND KOHL RABI.

Four varieties of Kale were grown, *Curled Scotch, Dwarf Moss, German Dwarf Purple and Green Scotch Curled*, the seed of which was all obtained from D. M. Ferry & Co., Detroit.

The *Curled Scotch* is a light green, dwarf spreading variety, reaching under good treatment a diameter of three feet. The leaves are very curled on the border and of a mild, sweet flavor when cooked. Greatly admired by some people for salads, and is grown for greens during the winter, as it will endure a low temperature without injury.

Dwarf Moss is a very close curled, green variety, growing a little taller than *Curled Scotch*, but not as spreading, averaging about twenty-four inches in height.

German Dwarf Purple is a very attractive variety; low growing, spreading to a diameter of three to four feet; fine curled and of a rich purple color. Not as sweet flavor as the green sorts but more attractive.

Green Scotch Curled is a tall growing sort, often reaching three to four feet in height. Not as spreading as the dwarf kinds and leaves are not set as close on the stalk. Of mild flavor and very tender.

KOHL RABI.

Seed was obtained from D. M. Ferry & Co., of two varieties of Kohl Rabi, the *White* and *Purple Vienna*, which differ only in color. They grow a large bottom, smooth, having but few leaves and small roots. A choice vegetable for many people when cooked and eaten the same as cabbage.

CUCUMBERS.

The cucumbers were planted June 2. The following table gives the varieties planted and the dates when the fruits were of pickling size and when ready for slicing.

CUCUMBERS.

Variety.	Seedsman.	Date of pickling size.	Date of slicing size.
Albino	Ferry	Aug. 3	Aug. 8
Cluster—Early	Ferry	July 21	July 27
Commercial Pickle	Thorburn	July 29	Aug. 5
Cool and Crisp	Ferry	July 31	Aug. 3
Emerald	Childs	Aug. 4	Aug. 10
Eskimoso	Johnson & Stokes	July 19	July 24
Green Prolific	Henderson	July 24	July 29
Long Green	Ferry	Aug. 3	Aug. 10
Market Garden	Salzer	Aug. 1	Aug. 6
Persian	Salzer	July 26	Aug. 1
Prolific Pickle	Salzer	July 27	Aug. 1
Russian Early	Ferry	July 23	July 27
Short Green	Ferry	July 26	July 31
White Spine—Arlington	Vaughan	July 28	Aug. 1
White Spine—Early	Ferry	July 29	Aug. 3
White Spine—Evergreen	Johnson & Stokes	July 29	Aug. 3
White Spine—Fordhook	Burpee	July 29	Aug. 3
White Spine—Monarch	Buckbee	Aug. 1	Aug. 6
Japan No. 1	Oregon Agricultural College	Aug. 1	Aug. 7
Japan No. 2	Oregon Agricultural College	Aug. 3	Aug. 9
Climbing No. 4	Oregon Agricultural College	Aug. 6	Aug. 14
Chinese	Oregon Agricultural College	Aug. 3	Aug. 10

NOTES ON VARIETIES.

Albino is late, but the plants are strong growing and productive. It is an excellent sort to furnish small, white pickles. The variety is also good for table use because of its delicate flavor. A most desirable white sort for pickles or table use.

Emerald. The plants are of strong growth but scarcely so productive as many others. Fruits much the shape of *Arlington White Spine*, but later in maturing and without spines. Color, a rich, light green. An excellent sort for large, late pickles and for slicing purposes, because the fruits remain a long time in condition before ripening.

Eskimoso. Plants are of small growth and fruits are borne close to hill. The fruits closely resemble Russian in form, but the season is several days earlier. Excellent for small, early pickles, because of the firm flesh, its excellent quality and the late development of the seeds; also one of the best early slicing sorts.

Market Garden is one of the best slicing sorts on account of the strong growing, very productive plants, and its length of season for producing fruits.

Persian lacks quality. Is of no practical value.

Commercial Pickle is a good sort to grow for small to medium-sized pickles.

Cluster was the first variety to produce fruits suitable for slicing. As an early slicing sort it has a place.

Green Prolific, because of its great productiveness ranks among the first sorts for general pickling purposes.

Long Green. The merits of this variety for late pickles and for table use are well known.

White Spine. There are several strains of this well-known sort differing slightly in plant growth and form or color of fruit. All are good. This variety is the best medium season, general purpose cucumber.

Cool and Crisp closely resembles the White Spine class.

Japan No. 1 and No. 2. The seed of these sorts came from Japan. The plants are of strong, healthy growth, but less productive than most others grown. The fruits were of good size and form, and possessed a flavor distinct, but not unpleasant. No. 2 was later than No. 1 and better in quality. These sorts are inferior to our well-known varieties.

SUMMARY OF VARIETIES.

The following sorts are recommended for the purpose named:

For early pickles—*Russian.*

For early slicing—*Cluster.*

For early slicing and pickling—*Eskimoso.*

For general pickling—*Commercial Pickle* and *Green Prolific.*

For table use—*White Spine* and *Long Green.*

If a white sort is desired *Albino* would give satisfaction.

LETTUCE.

The forcing varieties were started early and the plants placed in hotbeds to test their adaptability for that purpose.

Tennis Ball forms very compact heads of medium size. The outer leaves are dark green, while the head is quite light in color, tender and of best quality. It matures quite early and was the best close heading sort in the beds.

Silver Ball is not so close heading as the preceding, the leaves are lighter green and tipped with white. The heads are attractive in appearance and their quality of the best. Scarcely so large as *Tennis Ball*, but a little earlier in maturing.

Sensation. A little later in maturing than *Silver Ball;* closely resembles that variety, but its leaves are more waved, heads more loosely formed, and it is scarcely so good in quality.

Boston matures about the same time as *Silver Ball;* heads a little larger, deeper yellow in color and less compact. Of longer season than *Silver Ball* and an excellent forcing sort.

Hubbard Market. A few days later than *Tennis Ball* and closely resembling that sort, but the heads are larger and not so close.

White Star. A large, loose heading sort, closely resembling *Black-seeded Simpson*, but earlier in maturing. It has a long season, and is one of the best large, loose heading sorts for forcing in hot-beds.

Buttercup forms close heads of a beautiful yellow color and of fine quality. It is not a quick growing sort.

Market Gardener's Forcing forms a large, loose head. The leaves are light green in color, considerably curled. It is a quick grower and stands heat well. Much like *Grand Rapids*.

Silesia. An upright, loose grower; does not form a head. An excellent sort to grow for early cutting, as the leaves may be cut when quite small.

Landreth Cutting. Manner of growth quite like *Silesia*, but the leaves are smaller and it is a quicker grower.

LETTUCE OUT OF DOORS.

Plants of the varieties above mentioned, together with twenty other sorts, were transplanted to the open ground May 6. The data given in the table below were obtained from this planting.

LETTUCE.

Variety.	Seedsman.	Date of maturity.	Average weight of a single head.
Black Seeded Butter	Ferry	June 15	14 oz.
Boston	Ferry	" 15	1 lb. 3 oz.
Blonde Beauty	Vaughan	" 18	1 lb. 13 oz.
Bloomsdale Reliable	Landreth	" 10	6½ oz.
Brown Dutch	Ferry	" 18	13 oz.
Buttercup	Ferry	" 10	10½ oz.
Deacon	Ferry	" 13	14 oz.
Denver Market	Ferry	" 15	1 lb. 1½ oz.
Drumhead Cabbage	Ferry	" 14	9 oz.
Dwarf White Heart	Burpee	" 20	1 lb. 3 oz.
Frankfort Head	Ferry	" 13	9 oz.
Hanson	Ferry	" 15	1 lb. 7½ oz.
Hubbard Market	Ferry	" 13	9½ oz.
Iceberg	Vaughan	" 15	1 lb. 15 oz.
Landreth Cutting	Landreth	" 12	10½ oz.
Largest of All	Landreth	" 18	1 lb. 6 oz.
Market Gardener's Forcing	Ferry	" 10	8 oz.
Market Gardener's Private Stock	Ferry	" 14	9½ oz.
Mignonette	Henderson	" 10	15 oz.
Morse	Burpee	" 14	1 lb. 11 oz.
Ninety and Nine	Vaughan	" 11	8 oz.
Philadelphia Butter	Ferry	" 8	5 oz.
Prize Head	Ferry	" 12	1 lb. 1½ oz.
Sensation	Johnson & Stokes	" 14	15 oz.
Silesia	Ferry	" 18	1 lb. 8 oz.
Silver Ball	Ferry	" 12	11 oz.
Simpson Curled (black seed)	Ferry	" 13	1 lb. 10 oz.
Simpson Curled (white seed)	Ferry	" 15	1 lb. 9½ oz.
Sunset	Henderson	" 15	1 lb. 2½ oz.
Tennis Ball	Ferry	" 11	11 oz.
Tilton White Star	Ferry	" 15	1 lb. 7 oz.

Iceberg. This sort forms a very large head, quite close and compact. The outer leaves are a purplish green, lighter at tips, and curl over to protect the head from sun and to blanch it, making it tender and of best quality.

The heads remain in edible condition a long time before sending up a seed-stalk. A very valuable sort for garden use.

Morse. A lettuce of Simpson type, but it is a larger and better grower and stands heat better. Promises to be an acquisition in the garden as well as under glass.

Dwarf White Heart is a most excellent Cos variety, blanching well and of best quality and long standing.

Hanson, *Blonde Beauty*, *Simpson* and *White Star* are large growing, loose heading sorts, excellent for outdoor planting.

Prize Head. If one desires a dark-colored, purplish green lettuce of fine texture and long standing quality, this sort would be satisfactory.

Mignonette quite closely resembles Prize Head, but is earlier and forms a smaller, closer head.

ONIONS.

The experimental list of onions included twenty-nine American, one Siberian, one Mongolian and three Japanese varieties.

The excessive rains of the season retarded the growth of the American sorts and prevented their maturing; but the others were entirely drowned.

The *Bermuda* onions are gaining great popularity for quick growth, and large well formed bulbs.

The *Red* and *White* differ only in color, both having a thin skin, crisp flesh and mild flavor.

Bountiful, from Landreth, is a medium-sized, globular onion, with yellow skin and white, tender flesh.

Danvers Yellow, from D. M. Ferry. One of the standard varieties for commercial or domestic use, producing a round, firm bulb of good flavor, and fine keeping qualities. By a careful selection of seed of the Globe type a distinct form has been obtained called *Globe Danvers*, but the quality, texture and flavor are the same.

Extra Early Red, from Ferry, is much like Bermuda Red, of medium size and flat; very prolific and uniform in shape and size. A good, early market variety.

Gigantic Gibraltar, Burpee. The Gibraltar is very similar to Prizetaker, but more globular and of lighter color. It is a very fine looking onion, straw colored skin, white crisp flesh and very mild flavor.

The *Southport Globes*, *Red*, *White* and *Yellow*, also *Michigan Yellow Globe*, are varieties that need no description, as nearly every gardener's list includes them. They are all good shaped, prolific and mild-flavored varieties. The seed was obtained from D. M. Ferry & Co.

Golden Ball and *Ivory Ball*, from Johnson & Stokes, are two varieties that belong to the Globe class. They have respectively a bright yellow and pure white tender skin, snow-white, tender flesh and mild flavor. They are among the best keepers.

Gold Seal, from Landreth, is an early variety, resembling Extra Early Red, except in color, which is a bright yellow. A desirable early sort.

Golden, from Landreth. This is a very round variety, rich in color, much like the Danvers, but larger, harder and a better keeper. This seems to be a desirable acquisition for the market gardener's list or as a domestic variety.

Italian, from Ferry & Co. The white Italian onions embrace several varieties, viz.: Marzajola, Queen, Rocca, Silver King and Portugal, all being of good size, pure white, tender and good flavor.

These varieties, if sown thickly, produce fine pickling onions; but if sown very early in hot-beds, or under glass, and then transplanted, they will grow into large, delicious flavored bulbs.

Prizetaker. D. M. Ferry & Co. One of the standard varieties that needs no description.

The outside skin is rich purplish yellow; flesh, very white, tender and mild flavored; solid and a good keeper.

This is one of the best varieties for starting under glass and transplanting; much work in that line was done this season with satisfactory results.

Prizewinner, from D. M. Ferry, is an exact duplicate of Prizetaker, except in color, which is a pure white.

Every gardener should grow one of these varieties.

Silverskin, Round White, from D. M. Ferry, is a valuable early sort, as it grows very rapidly, and is extensively used for bunching.

It is very white, firm, crisp and mild flavored.

Strasburg, from Landreth. This leading yellow variety is globe shaped and of medium size, with a thin skin, and very tender, mild flavored flesh.

Wethersfield, from D. M. Ferry. Among the red onions this is the variety most commonly grown. It is very prolific, large, and considerably flattened; flesh, purplish white, fine grain, crisp and tender, but not as mild flavored as some others. A good keeper and shipper.

Yellow Dutch, from D. M. Ferry is nearly identical with Yellow Danvers, but is a little later. A good grower and shipper.

Zittan Giant, from Ferry, is a very large, yellow onion of superior quality.

PEAS, 1896.

The thirty-four varieties of peas grown this year included several of the older standard sorts, and the new ones sent out as novelties by the different seedsmen.

The object was not to see how many varieties could be grown, but to determine which are of superior merit, and if any of the new sorts are some old varieties renamed, thus aiding the grower in selecting only desirable kinds.

The seed was sown April twenty-seventh, in double rows, the drills being four inches deep, and twelve feet long, using about one seed to each two inches, or one hundred and forty-four for each variety.

Heavy rains followed immediately, and packed the soil, preventing many of the sprouts from coming up and causing others to rot.

The varieties Crown Prince, New Life, Nott's Excelsior, Renown, Nott's No. 961, and Telephone seemed to be most injured, and showed the smallest per cent of seeds germinated.

The rains which followed during the season afforded an abundant supply of moisture and a good crop was grown.

The Alaska reached edible maturity June 13, thus being the earliest variety.

Peas may be divided into seven distinct classes, as follows, viz.:

CLASS I.—Plants tall, exceeding four feet; seeds white or cream colored; pods curved.

Black-eyed Marrowfat. Plants four to five feet high, branching at base but very slender. Foliage dark green, stipules large; pods light green, strictly canoe shaped, and blunt at apex, containing six to seven spherical moderately sweet peas; very similar to the old White Marrowfat, but differing in having a curved pod, and a round, dark brown spot on that part of the seed called the hilum; a little later coming to maturity.

900 to 1. A new variety put out by Landreth, with vines four to five feet high; foliage light green; stipules large; pods slightly curved and very pointed at apex; small in size but containing seven to eight very plump, round peas, with a sweet, rich flavor. It promises to be a valuable variety.

CLASS II.—Plants tall, exceeding four feet; white or cream-colored seeds, curved pods.

Champion of England, a true type of this class, is one of the oldest varieties, and is extensively grown for late commercial and domestic purposes.

Giant-podded Marrowfat. A new variety sent out by Johnson & Stokes this season. Plants three and one-half to six feet high, branching at base, with stout stems; foliage dark green; pods dark green, large, broad, straight, blunt at apex, and three to four inches in length; peas large, round, flattened a little when old; sweet; generally six to eight in each pod; season late; quality fine. It mildewed badly or would be considered equal to Champion of England.

Telegraph and *Telephone* are two varieties that belong to this class. They are very similar, and differ from Champion of England in being shorter and several days earlier.

The pods are large and plump, containing five to eleven sweet, highly flavored peas. They are excellent medium late, wrinkled sorts.

CLASS III.—Half dwarf varieties, two to four feet high. Peas smooth or slightly indented; white or cream colored; pods straight, or nearly so.

Ferry's Extra Early is a good type of this class, and is nearly identical with the old variety Daniel O'Rourke.

The vines are two to three feet high, and are quite vigorous and productive. Foliage dark; pods dark, good size, broad, blunt at apex, usually five to six plump, round, sweet peas in each.

In quality this variety equaled Daniel O'Rourke, but did not show quite as large a per cent of peas.

Eugenie. Introduced by Landreth. Vines three to four feet high; foliage dark; very prolific; pods medium size, light colored and canoe shaped; peas four to eight in each pod, sweet and tender. Would not recommend it as a commercial variety, fearing that it would not endure a drouth, as the vines are very spindling.

Horsford's Market Garden, from Ferry, and *Market Gardener's Second Early*, from Johnson & Stokes, are almost identical with Bliss Everbearing, differing only in having larger and darker-colored vines. The vines are two and one-half to three feet high and very productive. Foliage very dark. Pods straight, plump, smooth, blunt at apex. Peas, round, sweet, tender, and four to seven per pod. A good variety for second early.

New Life.—A new variety from Gregory. Vines two and one-half feet high, strong growers; foliage, dark green; very prolific. Pods long, straight and broad, containing from five to eight sweet-flavored peas. This variety

and *Shropshire Hero* resemble an Improved Stratagem and are desirable acquisitions to a gardener's list for second early. They are very productive and of superior quality.

CLASS IV.—One-half dwarf; seeds blue or bluish-white; pods straight.

Dwarf Sugar, recommended by Landreth, is the sole representative of this class. Vines strong, vigorous growers, two to two and one-half feet high. Foliage, light green; pods, long, straight, blunt at apex, with indentations marking the location of peas. Peas, very sweet, averaging six to ten per pod. The pods are edible and are used the same as string beans. A very promising variety, prolific and of high quality.

CLASS V.—Vines half dwarf; seeds green, bluish-green, white and cream colored; seeds shriveled. Type, Alaska.

Alaska. From D. M. Ferry. Vines, two and one-half feet high, vigorous, strong growers. Pods, good-sized, containing four to seven large, sweet peas. The Alaska is very prolific and reached edible maturity several days in advance of Daniel O'Rourke and other early sorts.

Crown Prince. A variety introduced by Johnson & Stokes. Vines two to three feet high, foliage dark green. Vigorous growers; very prolific, in pods containing four to seven large, plump, sugary peas. This promised to be equal to Alaska but did not mature quite as evenly.

Daisy. Sent out by J. J. H. Gregory. Very few seeds germinated. Vines strong and vigorous, with dark green foliage. Pods large, plump, smooth, containing six to ten sweet, tender peas. It matured all its pods on the same day.

Echo Disseminated by W. A. Burpee. Vines two to three feet high; foliage very dark green; pods long, broad, some glaucous. Peas large, oval to spherical, tender and sweet, averaging six to seven per pod. Echo resembles Daisy, and they promise to be two valuable early sorts.

Bliss' Everbearing at one time was a leading variety but is now excelled by Alaska and other new sorts.

Hancock. Sent out by Gregory, and *Rural New Yorker*, from D. M. Ferry, were so nearly alike that no marked difference could be detected. Vines two to three feet high; foliage dark green; pods medium size, containing five to six peas, of fair flavor and texture, but inferior to Alaska and several other kinds.

Renown. Introduced by Burpee. Vines two to three feet high; vigorous, and dark green in color. Pods large, three to four inches long, slightly curved; peas plump, tender, sweet, averaging four to seven in each pod. It is well worth further trial.

Shropshire Hero, from Gregory, and *Stratagem*, from D. M. Ferry, are old varieties closely resembling each other, except that Hero is a little earlier. They are vigorous and prolific bearers of good flavored peas.

CLASS VI. Vines dwarf, one-half to two feet high, seeds green, bluish green, or cream colored; seeds much shriveled; pods straight, or nearly so.

Nott's Excelsior. Received from D. M. Ferry. This is a true type of the dwarf varieties. Vines nine to twelve inches high; vigorous, strong growers; foliage dark green; pods large, straight, and blunt at apex; peas plump, tender, very rich, averaging six to eight in a pod.

Nott's 961. Originated by Nott in 1895. The only difference between this variety and Excelsior is that it is a few days later and more productive, making it a valuable addition to the list of dwarf varieties. The quality is superior, not excelled in the earlier sorts.

Advancer. From D. M. Ferry. A variety growing a little taller than Excelsior, and two or three days later. Vines are dark green and vigorous in growth; not very prolific, but the peas are sweet, tender, and of fine form.

McLean's Gem and *Premium Gem*, both from D. M. Ferry, seemed to be much alike. Vines one to two feet high, vigorous and spreading; foliage dark green; pods light colored, two to three inches long, blunt at apex, containing six to seven plump, tender, sweet peas. The Gems stand foremost as second early varieties.

Tom Thumb Dwarf and *Tom Thumb Early*, from Ferry, are varieties appearing to be improvements on King of the Dwarfs. Vines eight inches high; vigorous growers; foliage dark green; pods straight, blunt, containing three to seven peas of superior quality. The only difference between the two sorts is that the Early seemed to be more prolific. Both are good verieties of this type, but not as prolific or of as fine quality as Excelsior.

Class VII.—Edible podded varieties:

French Sugar. One of Landreth's new varieties. The plants are very strong, about four feet high, branching at the base. Foliage light green; pods, broad, long, blunt at apex and slightly indented between the seeds; each containing from four to eight round, plump, sweet peas.

Melting Sugar. Sent out by Ferry. Vines strong, vigorous growers, with dark foliage and light-green pods; pods broad, blunt at apex and short, containing only four to six sweet-flavored, tender peas.

PEAS.—LIST OF VARIETIES.

No.	Variety.	Seedsman.	Per cent grew.	Date first blossom.	No. days from planting to edible maturity.	Length of edible maturity. Days.	No. of peas in each pod.	Per cent of peas to total weight.
1	Advancer	Ferry	75	June 2	54	12	6-7	36
2	Alaska	Ferry	98	May 25	47	14	5-6	35
3	Asparagus	Burpee	80	June 2	54	7	4-5	28
4	Champion of England	Ferry	80	June 16	70	13	4-9	38
5	Crown Prince	Johnson & Stokes	2	June 17	81	5	4-7	41
6	Daisy	Gregory	16	June 4	61	20	6-10	37
7	Daniel O'Rourke	Ferry	97	May 25	50	16	3-6	36
8	Dwarf Sugar	Landreth	99	June 14	61	20	6-10	43
9	Echo	Burpee	85	June 16	71	12	6-7	42
10	Eugenie	Landreth	25	June 8	72	14	4-8	46
11	Everbearing (Bliss)	Ferry	90	June 16	72	12	3-6	37
12	Everbearing (Bliss)	Gregory	99	June 18	62	17	4-7	41
13	Extra Early	Ferry	95	May 26	50	16	4-5	38
14	French Sugar	Landreth	98	June 15	72	14	4-6	30
15	Gem (McLean's)	Ferry	92	June 6	52	13	6-7	30
16	Gem (Premium)	Ferry	94	May 30	52	12	5-7	33
17	Hancock	Gregory	98	May 26	50	13	6-7	30
18	Horsford's Market Garden	Ferry	92	June 15	62	9	5-8	39
19	Market Gardener's Second Early	Johnson & Stokes	94	June 11	68	17	4-7	48
20	Marrow (Giant Pod)	Johnson & Stokes	45	June 17	68	14	6	38
21	Marrowfat (Black Eyed)	Ferry	92	June 19	71	15	6-7	39
22	Melting Sugar	Ferry	65	June 12	67	9	4-6	27
23	New Life	Gregory	8	June 15	71	17	5-8	36
24	Nott's Excelsior	Ferry	9	May 30	52	8	6-8	40
25	Nott's 961	Nott	15	May 29	58	8	4-6	34
26	900 to 1	Landreth	98	June 16	65	9	7-8	43
27	Renown	Burpee	2	June 15	72	12	4-7	30
28	Rural New Yorker	Ferry	98	May 26	50	15	5-7	35
29	Shropshire Hero	Gregory	70	June 11	69	17	6-9	41
30	Stratagem	Ferry	25	June 16	71	15	6-11	39
31	Telegraph	Ferry	80	June 11	67	17	7	29
32	Telephone	Ferry	9	June 11	70	16	5-11	44
33	Tom Thumb (Dwarf)	Ferry	90	June 2	52	9	5-7	39
34	Tom Thumb (E'y)	Ferry	92	May 29	51	16	5-7	38

POTATOES.

One hundred and sixty-five varieties of potatoes were experimented with during the past season, including forty-eight new sorts sent out by leading seedsmen. The balance are some of the standard varieties that have been grown several years.

A few of the chemical fertilizers were used and some work was done along the line of irrigation; but owing to the excessive rains the results were such that no comparison could be made.

The land used for the early varieties is located near the northwest corner of the vegetable garden; it is a sand loam with a subsoil composed of clay mixed with a large per cent of quicksand.

Vines were grown on the ground last season and after they were removed it was heavily manured with fine compost, and plowed.

Early in the spring the ground was plowed and well worked with roller and Acme harrow, until, at the date of planting (May 16), it was a very firm, mellow seed bed.

The ground was marked with furrows three and one-half feet apart, and each variety was given forty feet of space in the row; two pounds of seed were taken for each sort and cut into forty pieces; one piece was used for each hill, making them twelve inches apart.

The seed was dropped by hand with the eye up, and covered about four inches.

After planting, the ground was rolled and on the fourth day it was worked with Breed's weeder, which loosened the crust and prevented the growth of any weeds.

This weeder was used once each week until the plants were from five to six inches in height, after which the Planet Jr. cultivator was used weekly or after every rain, until the vines covered the ground. Shallow cultivation was strictly adhered to, keeping the ground as level as possible.

The plot for the late varieties is located in the northeast corner of the vegetable garden, where the soil is much stronger in vegetable humus, and has a sand loam mixed with clay for a subsoil, which makes it more fertile than the soil in which the early varieties were grown. The preceding crop was potatoes, and the ground was treated the same as for the early sorts, and planted June second.

The same amount of seed, two pounds, was cut into twenty-five pieces, and given forty feet of space.

The planting and cultivating was conducted the same as with the early varieties.

The table of variety tests shows the results. The new varieties grown in the test this year were obtained from the following parties:

Peter Henderson & Co., 35–37 Cortland St., N. Y.—Uncle Sam and a variety numbered $2\frac{4}{3}1$.

Currie Brothers, Milwaukee, Wis.—Lakeside Champion, Snowflake Jr., Milwaukee.

B. W. Steere, Carthage, Ind.—Early Pinkeye, Extra Early Six Weeks Market.

W. H. Maule, Philadelphia, Pa.—Maule's Early Thoroughbred.

Edwin F. Dibble Seed Co., Honeoye Falls, N. Y.—Rose No. 9, Honeoye Rose.

John A. Salzer, Lacrosse, Wis.—Inability, Champion of the World.

Johnson & Stokes, Philadelphia, Pa.—Pride of the South, Table King.

A. E. Manum, Bristol, Vermont.—Enormous.

Herrick Seed Co., Rochester, N. Y.—Peachblow Seedling.

Geo. W. P. Jerrard Co., Caribou, Maine.—Country Gentleman.

J. M. Fluke, Nankin, Ohio.—Wise Seedling.

E. L. Olds, Clinton, Wis.—Vigorosa.

Fred E. Young, Rochester, N. Y.—King of Roses, Early Bell, Fottler's Peachblow.

Matthew Crawford, Cuyahoga Falls, Ohio.—Flagle.

E. H. Vick, Rochester, N. Y.—Puritan, Vick's Early Excelsior, Napoleon, Good News, Vick's Abundance, Irish Cobbler, Stump the World.

M. A. Crawford, Attica, Mich.—Michigan Beauty, Queen of the Field.

E. G. Saxton, Springport, Mich.—Vick's Early Pride, Orphans, Quick Crop, Vick's Harvest Queen, Maggie Murphy, Farmer's Alliance, Rutland Rose, Sure Crop, White Mountain, American Beauty.

SUMMARY OF PROMISING VARIETIES.

The varieties that should rank among the standard sorts are mentioned in the following lists. Those marked with the star (*) grew in soil that lacked in fertility as compared with the late plot; which, together with the fact that the early varieties are lighter yielders, explains the reason of the noticeable difference in the output.

Early Varieties.

The varieties maturing first, and giving the largest yields, per acre, were Irish Cobbler (193.37 bu.) and Early Pride* (155.5 bu.), while Early Michigan* (155.8 bu.), Early Norther* (133 bu.), Early Pinkeye* (142.5 bu.), Early Walton* (150.31 bu.), Early Woodbury* (145.1 bu.), and Quick Crop,* with a yield of (134.76 bu.), were nearly as productive.

Medium Early.

Rose No. 9* (171.05 bu.), Early Bell* (145.13 bu.), are very promising medium sorts, and were closely followed by two varieties, Good News* (132.07 bu.) and Acme* (132.17 bu.), which are equal in quality and nearly as productive.

Medium Late.

Livingston Banner (425.03 bu.), Country Gentleman (388.75 bu.), Wise's Seedling (357.64 bu.), Napoleon (342.1 bu.), Lakeside Champion (336.91 bu.), Rutland Rose (331.73 bu.), and Inability (316.18 bu.), Rural New Yorker No. 2 (362.83 bu.), Supplanter (321.36 bu.), Troy Seedling (326.55 bu.), and Vanguard (383.56bu.), comprises the list of the medium late varieties.

Late Varieties.

Among the late sorts the heaviest yielders were, Enormous (502.78 bu.), and Champion of the World (425.03 bu.), but Fottler's Peachblow, yielding 352.46 bushels, Maggie Murphy (383.56 bu.), Carman No. 3 (300.63 bu.), Cayuga, (393.93 bu.), Great Divide (363.93 bu.), Hicks 22 (399.1 bu.), Hicks 101 (347.28 bu.), White Manhattan (404.3 bu.), White Prize (378.38 bu.), and World's Fair (336.91 bu.), are varieties of much merit. There are many other varieties that have been grown for several years and are reliable, notes and descriptions of which may be found in the previous bulletins.

TEST OF VARIETIES. 1896.

[Varieties marked with * were planted in the early plot.]

Variety.	Date of ripening.	Yield. Bushels per acre. Large.	Bushels per acre. Small.	Bushels per acre. Total.	Total yield. 1895.	Average yield. 1895, 1896.	General average.	Number of years. Averaged.
Abundance	Sept. 22.	248.8	36.28	285.08	....	....	....	1
*Acme (Allen)	" 15.	132.17	31.1	163.27	....	....	....	1
*Acme (Dep't)	" 12.	109	33	142	275	218.5	165.66	3
*Adirondac	" 20.	134.73	31.1	165.83	....	....	....	1
Alexander Prolific	Oct. 10.	295.45	41.46	336.91	259.25	298.08	234.49	3
*Alpha	Sept. 15.	44.05	18.14	62.19	277.25	169.72	139.86	4
American Beauty	Oct. 10.	243.61	51.82	295.43	....	....	....	1
American Wonder	" 15.	25.91	10.36	36.27	379	237	200.65	5
*Beauty of Hebron	Sept. 20.	176.22	38.87	215.09	151	183.04	166.51	8
Bill Nye	Oct. 20.	77.75	41.46	119.21	179.5	149.35	143.34	5
*Bovee's Seedling	Sept. 5.	82.88	44.05	126.93	264.5	195.71	....	2
Breck's Chance	Oct. 5.	119.21	31.1	150.31	119.25	134.78	....	2
*Carman No. 1 (Dep't)	Sept. 30.	124.6	12.95	137.55	244.5	191.02	188.68	3
Carman No. 3 (Dep't)	Oct. 20.	300.63	25.91	326.54	280.25	303.39	....	2
Carman No. 3 (Hammond)	" 20.	207.33	20.73	228.06	....	....	....	1
Cayuga	" 25.	393.93	72.56	466.49	277.75	372.12	222.69	5
Champion of the World	" 28.	425.03	25.91	450.94	....	....	....	1
*Clay Rose	Sept. 15.	46.65	25.91	72.56	361.5	217.03	....	2
*Columbian Rose	Oct. 20.	46.65	36.28	82.93	252.75	167.84	220.42	4
Colorado Peachblow	" 20.	134.76	51.82	186.58	....	....	....	1
Country Gentleman	" 18.	388.75	67.38	456.13	....	....	....	1
Crown Jewell	" 18.	176.22	20.73	196.67	188	192.33	189 44	6
*Cyclone	Sept. 10.	88.11	33.59	121.7	266.5	194.1	131.4	3
Drouth Proof	" 10.	248.8	46.65	295.45	242	268.72	....	2
*Early Bell	" 26.	145.13	25.91	171.04	....	....	....	1
*Early Excelsior	" 25.	103.66	41.46	144.12	....	....	....	1
*Early Fortune	" 10.	88.11	33.69	121.9	236	178.9	....	2
*Early Market	" 8.	57.01	36.28	93.29	....	....	....	1
*Early Mayflower	" 18.	80.34	25.91	106.25	....	....	....	1
*Early Michigan (Dep't)	" 1.	145.13	33.69	178.82	299.75	239.28	....	2
*Early Mich. (Hammond)	" 10	186.6	36.28	222.88	....	....	....	1
*Early Minnesota	" 15.	77.75	26.91	104.66	133	118.83	128.27	6
*Early Norther (Dep't)	" 20.	98.48	12.95	111.43	287	199.16	189.08	4
*Early Norther (Allen)	" 10.	165.86	26.91	192.77	....	....	....	1
*Early Norther (Hammond)	" 12.	134.76	41.46	176.22	....	....	....	1
*Early Ohio	" 1.	108.85	31.1	139.95	....	....	....	....
*Early Oxford	" 15.	88.11	31.1	119.21	187	153.10	155.15	8
*Early Peachblow	" 27.	129.25	10.36	139.94	333.5	236.74	....	2
*Early Peterson	" 26.	111.44	20.73	132.17	281.25	206.71	183.64	3
*Early Pinkeye	" 20.	142.54	15.55	158.09	....	....	....	1
*Early Puritan	" 22.	28.5	12.95	41.45	....	....	....	1
*Early Pride	" 1.	155.5	20.73	176.23	....	....	....	1
*Early Six Weeks Market	Aug. 25.	31.1	5.18	36.28	....	....	....	1
*Early Thoroughbred	Sept. 10.	101.07	31.1	132.18	....	....	....	1
*Early Walton	" 10.	150.31	15.55	165.86	226.75	196.3	....	2
*Early Wisconsin	" 18.	93.3	2.59	95.89	277	186.44	99.97	5
*Early Woodbury	" 28.	145.13	46.65	191.78	....	....	....	1
Eclipse	" 20.	25.91	10.36	36.27	140.25	176.52	....	2
Enormous	Oct. 28.	502.78	36.28	539.06	....	....	....	1
Farmers' Alliance	" 25.	253.93	20.78	274.71	....	....	....	1
Fillbasket	" 25.	207.33	36.28	243.61	396	319.8	208.52	5
Flagle	" 25.	238.42	31.1	269.52	....	....	....	1
Fottler's Peachblow	" 28	352.46	41.46	393 92	....	....	....	1
*Freeman	Sept. 20.	108.85	12.95	121.80	370	245.9	191.04	6
*Gardner's Diamond	" 28.	111.44	12.95	124.39	343.5	233.94	....	2
General Purpose	Oct. 25.	259.16	62.2	321.36	....	....	....	1
Genesee Co. King	" 20.	31.1	10.36	41.46	285.5	163.48	168.69	5
*Good News	Sept. 20.	132.17	10.36	142.53	....	....	....	1
Governor Rusk	Oct. 25.	15.55	5.18	20.73	230.75	108 74	153.15	5

TEST OF VARIETIES.—CONTINUED.

Variety.	Date of ripening.	Yield. Bushels per acre. Large.	Bushels per acre. Small.	Bushels per acre. Total.	Total yield. 1895.	Average yield. 1895, 1896.	General average.	Number of years Averaged.
Great Divide	Oct. 28.	336.93	12.95	349.88	294.5	311.19	257.01	3
Halo of Dakota	" 2.	46.65	12.95	59.6	228	143.8	199.93	6
Harvest King	" 2.	243.61	20.73	264.34	329.25	296.79	....	2
Harvest Queen	" 20.	295.45	46.65	342.10	....	....	....	1
Heavy Weight	Sept. 30.	134.76	36.28	171.04	270	220.52	127.95	3
*Hicks' No. 12	" 1.	101.07	23.32	124.39	366.75	245.57	199.07	5
Hicks' No. 22	Oct. 18.	399.1	67.38	466.48	452	459.24	349.49	5
Hicks' No. 71	" 25.	67.38	10.36	77.74	273.5	175.62	190.99	3
*Hicks' No. 81	Sept. 10.	119.21	20.77	139.98	306.75	223.36	201.79	5
Hicks' No. 101	Oct. 26.	347.28	28.5	375.78	345.5	360.64	258.95	5
*Honeoye Rose	Sept. 15.	77.75	10.36	88.11	....	....	....	1
Illinois Queen	Oct. 10.	88.11	7.77	95.88	134	114.94	140.87	3
Inability	" 13.	316.18	20.73	336.91	....	....	....	1
Irish Cobbler	Sept. 5.	193.37	15.55	208.92	....	....	....	1
Irish Daisy	Oct. 20.	20.73	7.77	28.5	366.5	197.5	105	3
Ironclad	" 25.	46.65	28.5	75.15	210.5	142.82	141.83	5
Joe Davis	" 20.	160.68	28.5	189.18	308.75	248.96	216.42	4
*June Eating	Aug. 25.	93.3	10.36	103.66	257.5	180.58	195.23	7
King of the Earlies	Sept. 10.	77.75	10.36	88.11	205.5	146.8	....	2
*King of the Roses	" 25.	124.6	36.28	160.88	....	....	....	1
Lakeside Champion	Oct. 15.	336.91	46.65	383.56	....	....	....	1
Lazell's Seedling	" 17.	181.41	25.91	207.32	168.5	187.91	253.06	5
*Lightning Express	Sept. 26.	158.09	10.36	168.45	290	229.23	201.65	3
Livingston's Banner	Oct. 12.	425.03	2.59	427.62	....	....	....	1
Maggie Murphy	" 28.	383.56	25.91	409.47	....	....	....	1
Mammoth Pearl	" 10.	155.5	31.1	186.6	269.75	228.17	184.77	4
Main Crop No. 1	Sept. 28.	300.63	31.1	331.73	190	260.86	210.57	3
*Milwaukee (Dep't)	" 7.	93.3	15.55	108.85	310	209.42	178.5	3
*Milwaukee (Currie)	" 10.	93.3	10.36	103.66	....	....	....	7
Michigan Beauty	Oct. 10.	95.59	23.35	119.34	....	....	....	1
Money Maker	" 10.	207.33	36.28	243.61	245.25	244.43	....	2
Mulla	" 12.	139.95	28.5	168.45	183.5	175.97	161.49	5
Muskrat Choice	Sept. 25.	20.73	5.18	25.91	240	132.95	121.97	3
Napoleon	Oct. 5.	342.1	88.11	430.21	....	....	....	1
North Pole	" 20.	95.89	23.32	119.21	320	219.6	170.9	3
Northern Spy	" 25.	259.16	15.55	274.71	....	....	....	1
O. K. Mammoth	" 20.	285.08	31.1	316.18	375.25	345.71	214.57	6
*On Top	Sept. 26.	93.3	10.36	103.66	393.25	248.45	187.73	5
One Hundred-fold	Oct. 23.	41.46	5.18	46.64	192.5	124.57	121.98	3
Oregon Pearl	" 18.	285.08	23.32	308.40	336.75	322.57	....	2
*Orphans (Dep't)	Sept. 25.	132.17	10.36	142.53	345	243.76	....	2
*Orphans (Saxton)	" 25.	119.21	15.55	134.76	....	....	....	1
Paris Rose	Oct. 20.	46.65	36.28	82.93	383.5	233.21	187.38	5
Parker's Market	" 22.	161.11	15.55	206.66	229.5	218.08	....	2
Park Region	" 18.	264.35	15.55	279.9	376.5	328.2	254.47	4
Peachblow Seedling	" 18.	409.48	25.91	435.39	....	....	....	1
*Pearl of Savoy	" 13.	103.66	20.73	124.39	366.5	245.44	187.87	5
Potato, from Cordley	" 12.	176.23	31.1	207.33	....	....	....	1
*Potato, from Peck	" 1.	41.46	10.36	51.82	....	....	....	1
President Lincoln	" 25.	228.06	31.1	259.16	221	240.08	225.77	8
*Pride of the South	Sept. 10.	41.46	15.55	57.01	....	....	....	1
Prize	Oct. 15.	290.26	36.28	326.54	206.5	266.52	....	2
Prizetaker	Sept. 10.	109.96	7.77	117.73	326.5	222.11	193.52	3
*Queen of the Field	Oct. 12	41.46	10.36	51.82	....	....	....	1
Queen of Paris	" 12.	303.22	67.38	370.6	234	302.3	245.54	6
Queen of the White House	" 15.	176.23	20.73	196.96	341.25	269.1	....	2
*Quick Crop	Sept. 1.	134.76	25.91	160.67	....	....	....	1
*Reed's '86	" 1.	119.21	20.73	139.94	160	149.97	....	2
*Reeves' Rose	" 20.	51.83	7.77	59.6	218.5	139	129.3	3
*Restaurant	Aug. 28.	36.29	10.36	46.65	293.5	169.87	138.25	5
Rural N. Yorker, No. 2 (D'pt)	Oct. 1.	362.83	41.46	404.29	204.75	304.52	196.18	7

TEST OF VARIETIES.—CONCLUDED.

Variety.	Date of ripening.	Yield.			Total yield. 1895.	Average yield. 1895, 1896.	General average.	Number of years. Averaged.
		Bushels per acre. Large.	Bushels per acre. Small.	Bushels per acre. Total.				
R. N. Y. No. 2 (Ham.)	Oct. 1.	404.3	77.75	482.05	....	....	....	1
Rochester Favorite	" 10.	202 33	20.73	223.06	208	215.53	206.13	3
*Rose No. 9	Sept. 20.	171.05	10.36	181.41	....	....	....	1
*Rose Standish	Oct. 10.	145.13	31.1	176 23	....	....	....	1
Rutland Rose	" 1.	331.73	67.38	399.11	....	....	....	1
*Seneca Beauty	Sept. 20.	114.03	25 91	139.94	293.75	216.84	202.34	3
*Signal	" 1.	106.25	23.32	129.57	....	....	....	1
*Sir William	" 25.	98.48	5.18	103.66	228.25	165.95	168.41	3
*Snowflake Jr. (Currie)	" 20.	145.13	10.36	155.49	....	....	....	1
*Snowflake Jr. (Dep't)	" 20.	93.3	15.55	108.85	250	179.42	189.61	3
Somerset	Oct. 2.	62.2	7.77	69.97	204	136.98	....	2
Stanley	" 20.	295.45	51.83	347.28	121.66	234.47	211.05	5
*Statesman	" 18.	88.11	2.85	90.96	236.5	163.73	137.98	3
Storrs' Seedling	Sept. 28.	31.1	10.36	41.46	118.5	79.98	109.98	5
*Summit	" 20.	124.4	20.73	145.13	434.25	289.69	252.16	7
Supplanter	Oct. 5.	321.36	20.73	342.09	192	267.04	217.01	6
*Table King	Sept. 25.	142.54	18.14	160.68	....	....	....	1
*Telegraph	Oct. 1.	72.56	41.46	114.02	....	....	....	1
*Telephone	Sept. 18.	67.38	36.28	103.66	240.25	171.95	237.04	4
Troy Seedling	Oct. 10.	326.55	20.73	347.28	252.5	299.59	208.45	5
Uncle Sam	" 1.	103.66	25.91	129.57	....	....	....	1
241/3	Sept. 25.	165.86	15.55	181.41	....	....	....	1
*Vanguard	" 24.	383.56	15.55	399.11	245	322.05	265.87	3
Van Ornam	Oct. 2.	134.76	10.36	145.12	262	208.51	....	2
*Vaughan	Sept. 1.	72.56	25.91	98.47	300	199.23	164.11	4
Vick's Champion	" 30.	62.2	15.55	77.75	213.5	145.63	174.55	5
Vick's Harvest Queen	Oct. 1.	295.45	46.65	342.1	....	....	....	1
Victor Rose	" 1.	181.41	31.1	212.51	315.5	264	211	3
*Vigorosa	Sept. 20.	103.66	20.73	124.39	....	....	....	1
Watson Seedling	Oct. 10.	207.33	46.65	253.98	162	207.49	177.33	6
White Gem	" 1.	295.45	25.91	321.36	390	305.68	....	2
*White Lily	Sept. 17.	77.75	20.73	98.48	205	151.74	....	2
White Manhattan	Oct. 20.	404.3	36.28	440.58	294.5	367.54	....	2
White Mountain	Sept. 30.	51.83	10.36	62.19	....	....	....	1
White Prize	Oct. 15.	378.38	54.42	432.8	263	347.9	283.01	3
Wilson's First Choice	" 10.	332.88	41.46	378.37	315	346.68	....	2
Wise's Seedling	" 10.	257.64	25.91	283.55	....	....	....	1
World's Fair	" 15.	336.91	41.46	378.37	318.25	345.81	285.46	4
Woodbury White	" 15.	134.76	25.91	160.67	319.25	234.96	238.91	4
Wolverine Beauty	" 10.	129.58	28.5	158.08	216.5	187.29	178.08	
Unknown (from Upper Pen.)	" 25.	362.83	7.77	370.6	....	....	....	
*Unknown (from U. S. Dept.)	Sept. 17.	93.3	10.36	103.60	....	....	....	
*Stump the World	" 1.	67.38	18.14	85.52	....	....	....	

NOTES ON VARIETIES.

Abundance.—One of the new medium late sorts, very productive. Size, medium to large; shape, oblong, flattened; eyes, large, shallow and open, with a pink tint around the sprout centers; skin, smooth, with a slight russet appearance; flesh, very firm, white and dry. Promises to be a valuable variety.

Adirondac.—Size, medium to large; shape, flat oblong; eyes, of medium depth, open and white; skin, white, smooth, with a very fine russet grain and a few small, white specks on the surface; flesh, of medium texture, a

little spongy, and cream tinted. A good yielder, growing very compactly in the hill. Vines, very strong and vigorous.

American Beauty.—This new variety is a strong grower and a productive late sort. Size, large; shape, oblong, somewhat flattened; eyes of medium depth, white and not numerous; flesh, pure white, firm and of good texture. This variety has the characteristics of a superior potato and is worthy of further trial.

Champion of the World.—Size, large, irregular, oblong in shape; eyes of medium depth, broad and open; skin, dark, coarse, russet; flesh, a little spongy and cream tinted.

Country Gentleman.—A very productive new variety. Size, medium to large; shape, oval to oblong, slightly flattened; eyes, broad, shallow and pink tinted; skin, russet, white, streaked with pink; flesh, firm, dry, light cream colored. Season, late. It has few superiors.

Early Bell.—One of the promising new varieties. Size, medium; shape, oval and slightly flattened; eyes, broad, shallow, partly closed, white; skin, white, covered with light colored specks; flesh, dry, solid, firm, of fine texture and very white.

Early Excelsior.—Size, medium to large; shape, oblong, flattened; eyes, broad, open, shallow, on body, but of medium depth on the seed end; skin, pink tinted, with fine russet appearance; flesh, dry, white, fine grained. A very promising new sort.

Early Market.—One of the varieties extensively advertised. Size, medium; shape, short, oval to round; eyes, shallow, broad, white; skin, light russet, netted; flesh, dry, white, firm, fine texture. A variety said to be earlier than the Ohio, but it was a week later this year, and it does not promise to be a heavy yielder.

Early Pinkeye.—A variety of recent introduction. Size, medium to large; shape, flat, oblong, a little irregular; eyes, shallow, broad, partly closed, pink tinted; skin, smooth, light pink; flesh, dry, firm, and white. Seems to be worthy of further trial, as it is very attractive in appearance.

Early Puritan.—This is a valuable early variety on account of its high quality. The tubers are long and pure white, which makes them very attractive. Eyes are very shallow, and the tuber is quite smooth; flesh, white, very dry and starchy, equal to the old variety, Snowflake, which had no superior in quality.

Early Pride.—A very strong growing variety, and considering its earliness, one of the most productive. The tubers are medium to large in size, smooth, having but few shallow, pink eyes, coming even with the surface. The flesh is very white, dry and firm, giving it points of superiority that makes it worthy of further trial.

Early Thoroughbred.—One of the new varieties strongly resembling the original Early Rose, equaling it in every respect. Tubers large, long oblong, very regular and slightly flattened. The eyes are of the Rose type, deep, numerous and pink colored, set in a smooth, clear pink and white skin. The flesh is very dry, firm, and of fine texture. Considering productiveness and quality it is a valuable variety for market or home use.

Enormous.—This gave the largest yield of any of the varieties, but was inclined to grow rough, which was probably caused by the wet, warm weather encouraging a new growth. Size, large, with small per cent of unmarketable potatoes. Shape, long oblong, rather irregular; eyes, numerous, deep, broad and open; skin, white with fine russet markings.

The flesh is very white, dry, solid and of firm texture. It promises to be a good keeper, and this, taken together with the productiveness, makes it a valuable acquisition.

Farmers' Alliance.—One of the new sorts of the Rose class, but the vines have a stronger growth. The characteristics of the tuber are about the same as those of the Late Rose. A good yielder and worthy of further trial.

Flagle.—A very large growing new sort with a bright pink, netted skin. Shape, flat oblong; eyes, deep, broad, with lip projecting over center of eye. Flesh very firm, dry and white. Will be given further trial.

Fottler's Peachblow.—It appears to be similar to the original Peachblow, and without superior qualities sufficient to enable it to supersede it. A large yielder of rough, irregular tubers, with dry, white, solid flesh.

Good News.—A round, oval shaped variety, with medium sized shallow eyes tinted with pink; skin, white, specked with light dots; flesh, of good color and fine texture. Quite attractive and medium in productiveness.

Honeoye Rose.—A seedling of the Victor Rose, running back to the original Early Rose for its parentage. The tubers average larger than the Early Rose, and are more oblong in shape. Eyes, broad, open, rather deep set, shading from pink to deep red color; skin, pale pink and finely netted. The flesh is white, firm and dry. Owing to its being as early as the Early Rose, and of better shape, it is bound to be a valuable new variety.

Inability.—Tubers of medium size; oblong and irregular in shape; eyes, deep, open, few in number; skin, white, smooth, specked with small light dots; flesh, white, a little spongy.

Irish Cobbler.—A new early variety, for which great claims are made. In shape it resembles the Early Ohio. The skin is of a creamy white tint, slightly netted; eyes, strong, well developed, but slightly depressed; flesh, white, firm, and when cooked very floury. It ripens about the same time as the Ohio, but is much more productive.

King of the Roses.—One of the new, oblong, Rose varieties of considerable promise. The tubers are regular in shape, of medium size, with a clear pink skin. Eyes, broad, nearly closed, and of average depth. The firm, dry, fine textured flesh makes it a desirable table sort, and it seems destined to be a valuable addition in the Rose growing localities.

Lakeside Champion.—This seems to be a potato that will gain prominence among the late market varieties. It is a strong grower; vines of an upright, vigorous habit; size of tubers large, with very few small ones. Their shape is long, oblong, flattened; eyes are few in number, deep, partly closed, and pink to red in color; skin, white, shaded with pink, smooth, finely netted; flesh, firm, fine grained and white.

Livingston Banner.—But very few of the new sorts gave a larger yield than this, and, considering its good points, it will be, without doubt, a good market variety. The tubers are large, flat ovate in shape, very regular; eyes are few in number, slightly indented; skin, light russet, finely netted; flesh is very firm, cream white, and fine in texture. Appears to be a good keeper.

Maggie Murphy.—The large size and productiveness of this variety is gaining for it a widespread reputation. The tubers are of the Rose color, light pink, and very attractive. The top is very strong and vigorous in its growth; said to be especially adapted to sandy soil. Considering its size, the grain is good, and the flesh very white and dry.

Michigan Beauty. Tubers small; oval, oblong; eyes shallow, partly closed; skin white and smooth;flesh white, firm and of good texture. Not very promising, but will be given further trial.

Napoleon. A medium late variety, with the essentials required for a standard potato. Tubers are large, flat, ovate and very regular; eyes open and shallow; skin pure white; flesh very white, but it is a little spongy and showed some indications of rot in the hills.

Peachblow Seedling. A recent seedling of the Old Peachblow and nearly identical with Fottler's Peachblow. Not very promising.

Pride of the South. One of the earliest new varieties, but aside from its earliness it is not of any special value, as it is lacking in productiveness. Tubers are small to medium, oval shaped, with few very shallow open eyes. The skin is pure white; flesh firm, white and dry.

Rose No. 9. Another of the Rose varieties that promises to be of much value. Tubers are large, well formed, attractive and of good quality.

Rose Standish. Tubers medium to large, oblong flattened; eyes shallow; skin very pink, thin; flesh fine grained, white and dry. Not of especial value.

Stump the World. A very attractive, snow-white potato of medium size, but it is lacking in productiveness. The quality is good and it will be given further trial.

Table King. One of the most promising new varieties, although not very productive. In size it averages about the same as the Ohio, and is very similar in shape. The skin is a light russet color, with few shallow eyes; flesh very firm, white and dry, with a fine texture. It has few superiors in quality.

Uncle Sam. An attractive white potato that will be given further trial. A strong grower; good size; regular shape, but a little coarse and watery.

Harvest Queen. None of the new late varieties are more desirable. The tubers are large, round-oblong, slightly flattened; eyes few and shallow; skin white with a fine netted russet coating which usually marks a potato of superior qualities. The flesh is very dry, white and of fine texture. A strong grower and of average productiveness.

Vigorosa. One of the new varieties that possess merit sufficient to warrant further trial. An early white potato of medium size, cylindrical in shape, with few deep, open eyes. Skin smooth, white, with light pink markings; flesh very white, but a little inclined to be spongy.

Wise's Seedling. A remarkably strong growing variety; stalks large and vigorous, with an upright habit. Size of the tubers, large and a little inclined to be rough; shape, long to oblong, rather irregular; color, white tinted with pink; eyes, darker in color, shallow and few in number; flesh very firm, dry and white and appears to be a good cooker at any season of the year.

$2\frac{4}{3}1$. Although tested under rather unfavorable circumstances, this new early variety was quite productive and it seems likely to become one of the leaders. The tubers are large, smooth and very white, with slight pink markings; eyes large, strong, partly closed, rather numerous. The flesh is very solid, creamy white and of superior texture. Will be given further trial.

WHERE SHALL WE OBTAIN OUR SEED?

It is claimed by some seedsmen that to insure the largest crop of potatoes the seed should be northern grown, while others claim that tubers

grown on muck land are stronger and will produce more vigorous plants and a larger yield of tubers.

As a test along this line, several varieties grown in Northern Minnesota were secured and compared with potatoes grown in Southern Michigan on muck land, and others of the same varieties grown here on a sandy loam.

The site selected was a part of the early plot, located in the northwest portion of the vegetable garden. Two rows, two hundred and forty feet long, were taken for each variety, and twelve pounds of seed was used per row, the system of planting and culture being the same as with the other varieties.

Early Norther, from Minnesota, showed a gain of ten per cent over seed grown on muck land, while Acme gave an increase of thirty-two bushels per acre over the southern seed.

Early Michigan and Rural New Yorker No. 2, grown on muck land, made about the same showing over the seed grown here in a sandy loam, but it was undoubtedly due, at least in part, to the fact that the other seed was stored in pits while ours was kept in a common cellar, and had become somewhat shriveled before it was planted.

The Colorado beetles were very troublesome this season, which necessitated several applications of Paris green; while the plants were small it was applied with a powder gun, but after they were half grown, land plaster was used in the proportion of one hundred pounds to one of the poison. Water was also used at the rate of one hundred gallons to one-half pound of Paris green.

The entire crop of potatoes was treated with Bordeaux mixture to prevent the working of the early leaf blight, with satisfactory results.

RADISHES.

Seed of the forcing varieties was planted in the hot bed early in March to determine their value for the purpose named.

The forcing sorts, with but few exceptions, are of much the same type. All are of small size and quick maturity. The form differs from round turnip to olive shaped or half-long tapering; the color from white or yellow to all shades of red, scarlet and crimson. The flesh of some varieties is more crisp and tender than that of others, and remains longer in that condition. The time required to produce salable roots, and the size to which they will grow before becoming pithy, are of importance in selecting kinds to grow for this purpose.

Carmine Turnip, Non Plus Ultra, Round Deep Scarlet, Scarlet Globe, Startle and *Twenty Days Forcing* are quite similar in form, but differ in color, size, quickness of growth and crispiness of flesh. Of these *Startle* was the first to mature. It is of a bright, scarlet color, and the flesh is crisp and tender. *Non Plus Ultra* is a little later than *Startle*, but has whiter flesh, and is better in quality. Its season, however, is short, and it must be pulled at once.

Carmine Turnip, Round Deep Scarlet and *Twenty Days Forcing* matured at the same season, and are much alike in general appearance. *Twenty Days Forcing* is considerably larger in size than the others. *Scarlet Globe* was the last of the group to reach its growth, but the slight difference in time of maturity was more than made up in the increase of

size, it being nearly twice as large as any other, and the flesh was crisp and tender.

Deep Scarlet Olive Shaped and *Rose Olive Shaped* differ from the group above described in having roots oval in form, and longer. They are as early, and in bunching will pack more closely than the turnip rooted radishes.

French Breakfast produces roots that are two inches or more long, obovate in form, bright red in color, with lower part white. It is quick maturing, attractive in appearance, and good in quality. Quite generally grown as a forcing sort.

Golden Globe and *White Olive Shaped* are not largely grown because of their color.

Long Brightest Scarlet. This sort is almost as quick growing as the smaller sorts, is as attractive in appearance and as good in quality, while the largely increased size is a point of great superiority.

All the varieties of radish were sown in the open ground May 12. The following table gives the date of maturity of the several sorts grown.

Variety.	Seedsman.	Date of edible maturity.
Carmine Turnip	Vaughan	June 5
Deep Scarlet Olive Shaped	Ferry	" 5
French Breakfast	"	" 5
Golden Globe	"	" 7
Gray Summer Turnip Rooted	"	" 16
Half-long Black Winter	"	July 8
Long Black Summer	"	" 7
Long Brighest Scarlet White Tipped	"	June 6
Long White Naples	"	" 21
Non Plus Ultra	"	" 4
Rose China Winter	"	July 9
Rose Olive Shaped	"	June 5
Round Deep Scarlet	"	" 6
Scarlet Globe	"	" 6
Scarlet Turnip Rooted	"	" 5
Startle	Johnson & Stokes	" 2
Stuttgart White Giant	Ferry	July 6
Twenty Days Forcing	Vaughan	June 5
White Chartier	Henderson	" 15
White China Winter	Ferry	July 11
White Olive Shaped	"	June 6
White Strasburg	"	" 20
White Summer Turnip	"	" 16
White Turnip Rooted	"	" 6
White Vienna	"	" 20
Yellow Summer Turnip	"	" 15
Siberia	Oregon Ag. Col.	" 29
Mongolia No. 1	" " "	" 28
Mongolia No. 2	" " "	" 21
Japan No. 1	" " "	July 6
Japan No. 2	" " "	" 16
Japan No. 3	" " "	" 16

Unless the soil where radishes are grown is sandy and rich, the roots grow too slowly and become tough and wormy. For this reason some of the smaller growing sorts described among the forcing varieties would give better satisfaction to plant in the home garden. The seed can be sown every week or ten days and a good succession of table radishes obtained throughout the season.

Of the larger-growing radishes, *Long Scarlet Short Top, Chartier* or *Rose China* among the reds, and *White Naples* or *White Vienna* of the whites are recommended for general growing. If a medium-sized yellow skinned sort is desired, *Yellow Summer Turnip* is good.

Winter radishes are but little grown, no doubt because their good qualities are not generally known. While their flavor is quite sharp, they will keep through the winter and are most excellent as a relish. Usually the white sorts are the better keepers. The seed should be sown quite late, say the last of August, so that the growth may not become tough and pithy.

SQUASH.

The difficulty experienced in getting the young squash plants well established and beyond the attacks of the striped beetle has deterred many from planting this vegetable. When the number of hills is limited, perhaps nothing would be found more satisfactory than box frames made about one foot square and the tops covered with wire screen or mosquito netting. Place these frames over the hills before the plants come up and leave them there until the growth fills the boxes. When the boxes are removed the plants are usually so far along that they will withstand the attacks of the beetle. Wood ashes, with which a few drops of turpentine have been mixed, dusted on the plants, we have found effective in driving the beetles away. The squash bug begins to attack the plants when they are of some size. This is a very difficult pest to combat successfully. Squash plants are very tender and insecticides that would kill the bugs would also kill the plants. If boards are placed on the ground close to the vines, most of the bugs will crawl under them for protection during the night. Early in the morning the boards may be turned over and the pests killed.

VARIETIES.

Of the early sorts *Crookneck* and *Bush Scallop* are generally grown. While the quality of the early sorts is not equal to that of the winter varieties, yet, because of being ready for use long before the later kinds, they should have a place in every garden.

Straightneck, Vaughan, as grown here the past season, promises an improvement in increased size, with less of the curve that marks the *Crookneck*.

There is a class of squashes with flesh of good quality that mature in the fall and are good winter keepers. *Delicata, Perfect Gem, Fordhook* and *Cocoanut* are among the better sorts of this class and, as the plants can be depended upon to bear a large crop, they should be much more largely planted for home use than they now are.

With most squash growers *Hubbard* is the variety grown for winter use, *Marblehead* is a sort having a grayish-white skin with a nearly smooth surface, and while somewhat smaller in size than Hubbard, has less waste in preparing for use. The plants are as productive, the flesh as dry and as thick as the Hubbard, and even better in quality. It ripens a little earlier than Hubbard and should be largely grown as a late keeping sort. *Pike's Peak* is also an excellent winter squash.

SWEET CORN.

The test of varieties in sweet corn included thirty-two kinds, consisting of the leading standard sorts and many of the new ones sent out by different seedsmen. The corn was planted June eighth, in rows forty-two inches apart, with five kernels in each hill. The temperature and moisture were such that the seed germinated very quickly and a large per cent grew.

Adams' Extra Early, from Landreth, was the first variety to reach maturity; although it is not strictly a sweet corn, yet for family use, or early market, it does very well. The ears are six to eight inches in length, well tipped and filled with twelve rows of plump, broad, tender, juicy kernels.

Bonanza. One of Vaughan's medium varieties, has a very small cob. The kernels are long, broad, pure white, tender and rich in sugar properties. Its edible maturity is of long duration, making it a valuable sort.

California, from Childs, is very similar to Stowell's Evergreen, but does not have merit enough to take its place.

Champion is a new variety, sent out by Vaughan, that is promising as an early sort. The ears are large and long, well covered with twelve rows of snow white, plump, sweet kernels, set on a small cob. The hull of the kernels is very thin.

Chicago Market, from Vaughan, is one of the old commercial varieties; it is very prolific and of fair quality.

Concord, from Vaughan, is another standard variety with market gardeners and it needs no description to gain friends. One of the best medium season varieties.

Country Gentleman, from Maule, is an established variety that needs no praise, as the small cob, irregularly covered with long, plump, cream white, sweet kernels distinguishes it from other varieties. Its uneven time of maturing makes it valuable for the home garden. A common name for it is *Shoe Peg*, on account of the shape of the kernels, and their not being in rows.

Cory, White Cob, Vaughan. This was the first strictly sweet corn that reached maturity. It differs from the old Cory variety only in the color of its cob; size, shape, texture and flavor are the same.

Dawn, Johnson & Stokes. A variety larger than Cory, maturing four days later; ears well filled; kernels, cream white, large, deep, sugary and very juicy; rows, twelve to sixteen in number.

Egyptian, from Henderson, is a strong, coarse grower; ears very large, white and well covered; kernels, broad, plump, deep and of a peculiar rich flavor. It is a good variety for gardeners or for canning purposes.

Fordhook, one of Burpee's specialties, matured about the same time as Dawn. The ears are about the same size as those of Cory, and they differ but little except in the oval shape of the kernels.

Fottlers, sent out by Vaughan, is a few days later than Cory, and suckers badly. The ears are seven to nine inches in length and are well covered with corn rich in sugar.

First of All, from both Maule and Burpee, is one or two days earlier than White Cory, but there is little difference between them.

Gold Coin, from Vaughan, in growth and development is very much like Stowell's Evergreen, but is not equal to it in quality. The ears are large and well filled with yellow kernels.

SWEET CORN.—TABLE OF VARIETIES.

No.	Variety.	Seedsman.	Ears per square rod.	No. of days from planting to edible maturity.	Height of stalks. Feet.	Average No. of ears per stalk.	Average length of ears. Inches.	No. of rows of kernels per ear.	Length of kernels. Inches.	Diameter of cob. Inches.	Weight of ears. Ounces.
1	Adams' Extra Early	Landreth	210	53	6	1.15	6.5	12	.48	1	8
2	Bonanza	Maule	218	71	8	1.12	8.5	12	.5	1	10.6
3	California	Childs	123	81	9	.8	9	14	.43	1.25	11.3
4	Champion	Vaughan	207	58	6	1.15	7.75	12	.41	1.12	9
5	Chicago Market	Vaughan	186	56	6	1.15	7.25	12	.42	.87	7.6
6	Concord	Vaughan	146	65	7.5	.8	8	14	.46	1.25	9.4
7	Country Gentleman	Vaughan	105	80	8	1	8	20	.5	1	7.4
8	Cory (White Cob)	Vaughan	207	54	5	1.15	6	8	.33	.87	5.5
9	Dawn	Johnson & Stokes	194	58	7	1.12	7.75	14	.35	1	8.7
10	Egyptian	Henderson	151	93	9.5	.8	9	12	.37	1.2	10.8
11	Fordhook	Burpee	225	58	5	1.15	7	8	.43	.75	5.8
12	Fottler	Vaughan	223	60	5.5	1.14	7.5	12	.33	1	7.1
13	First of All	Burpee	201	54	5	1.1	6.75	10	.35	.87	6.6
14	First of All	Maule	194	54	5	1.1	7	10	.35	.87	6.4
15	Gold Coin	Vaughan	111	87	9	1	9.5	16	.56	1.12	10.3
16	Hickox Hybrid	Ferry	146	72	9	7	9.5	12	.48	1	11.1
17	Honey Dew	Childs	223	56	5	1.15	7	8	.31	.87	6.9
18	Improved Ruby	Burpee	105	81	8.75	1.25	8.5	14	.43	1.33	11.3
19	La Crosse	Salzer	237	58	6	1.2	7	10	.36	1	8
20	Landreth's Market	Landreth	155	58	6	.75	8	8	.37	1	7.8
21	Landreth's Sugar	Landreth	294	67	8.5	.6	8.5	14	.5	1.18	11
22	Leets	Ferry	214	65	7	1.1	8	12	.35	1	7.8
23	Mammoth	Henderson	220	98	10	1.14	12	16	.62	1.35	14
24	Minnesota	Ferry	239	63	7.5	1.33	7.5	8	.33	.87	6.7
25	New England	Ferry	158	56	7	.75	8	10	.38	.9	8.6
26	Nonesuch	Johnson & Stokes	190	78	8	1	8.5	12	.44	1	9.1
27	Northern Pedigree	Salzer	95	56	.5	.5	6	8	.44	1	7.1
28	Quincy Market	Gregory	125	63	7.5	.6	7	12	.44	.87	7.1
29	Roslyn Hybrid	Henderson	105	66	9	.5	8.75	14	.44	1.18	8.4
30	Stowell's Evergreen	Vaughan	110	90	9.75	.55	11	16	.62	1.25	16
31	Sugar, Early	Vaughan	198	57	6.75	1	7.5	12	.33	1	8
32	Vermont Extra Early	Vaughan	180	55	6.75	1.2	7.5	10	.33	1	7.75

Hickox Hybrid, Maule, is one of the best varieties for canning or drying; it is very prolific and shrinks but little in the can or in drying. The ears are large; cob small; kernels very white, sugary and well filled with milk.

Honey Dew, introduced by Childs, is an early eight-rowed variety with small ears covered with long thick husks. The kernels are plump and tender, but it is not as desirable as some other sorts.

Improved Ruby, Burpee. Its only peculiarities are the dark red stalks and husks; ears are large, well filled with pure white kernels of delicious flavor. A fair, medium late variety.

La Crosse, Salzer. A hardy and productive sort maturing well developed ears, medium length, with ten rows of broad, plump kernels; not of extra quality.

Landreth Market, Landreth. The leading feature of this corn is the length of the ears, averaging eight inches, and they are well filled with eight rows of round, plump, good sized kernels. It is not a true sugar corn, but is of the same nature as Early Adams.

Landreth Sugar, from Landreth, is a very promising variety. The ears are large, growing very low on the stalks; grain very narrow, long, white and sugary, remaining milky for a long period, which makes it desirable for canning or continuous marketing.

Leets, obtained from D. M. Ferry & Co., is about a week later than Cory. The ears are larger than those of the earlier sorts; cob small; kernels long and rich in sugar. It lasts well and is a good medium early variety, but it is not equal to Country Gentleman and some of the other varieties in flavor.

Mammoth, Henderson, grew the largest ears of any variety, and matured about three days later than Stowell's Evergreen, making it a valuable late sort. The ears are covered with long, broad, plump, milky, tender kernels that are rich in sugar.

Minnesota, from Ferry, is a variety maturing between Cory and Concord. It is better in quality than the former, and the ears are larger. The leading characteristic is the dense covering of the ears with long thick husks, and the broad flat form of the kernels.

New England, another variety from Ferry, grows a very long, slim ear, well covered with broad, tender, sweet kernels, but it is less desirable than Minnesota and other varieties. Much shriveled when dry.

Nonesuch, from Johnson and Stokes, is one of the medium varieties; a strong grower; ears of good size, with pink cobs, but with very white kernels that are tender and sweet. The leaves, stalks and the cob end of the kernels are tinged with pink.

Northern Pedigree, from Salzer, is a very dwarf-stalked variety, with small, plump ears, covered with deliciously sweet kernels; sweeter than Cory but not as productive.

Quincy Market, sent out by Gregory, is almost identical with Crosby, except that it is a few days earlier. The quality is about the same, but the flavor, if anything, is a little better. An excellent variety to follow Cory.

Roslyn Hybrid, from Henderson. This variety is a valuable medium late sort, remaining in edible maturity a long time. Its growth is much like Stowells' Evergreen. The ears are large, long, well filled and covered with broad, deep kernels of fine quality, tender and milky.

Stowell's Evergreen, Vaughan, is a standard variety, and by many considered to be the best sugar corn grown. The ears are very large and

long; kernels broad, deep, of cream white color, tender and very sweet. Its length of edible maturity is one strong point in its favor.

Sugar, Early, is one of Vaughan's introductions for this year, and appears to be nearly identical with First of All and Vermont Extra Early.

Vermont Extra Early, Vaughan. It grows strong stalks which average one good ear. The ears are a little larger and longer than those of Cory, but they have a larger cob. The kernels are of good length, well rounded, plump, juicy, and as sweet as any of the earlier sorts. It is preferable to Red Cory.

TOMATOES.

The seed was sown in the forcing house March 19. When ready the young plants were removed to boxes and set in the open ground May 27 and 28. The rows were five feet apart and the distance between the plants in the row was four feet. The plants grew very luxuriantly and bore large crops of fruit. The tomatoes were remarkably free from rot and no spraying was required.

In the table below will be found the date of first fruit ripening; the productiveness of each sort, compared in percentage, taking varieties producing the largest crop at 100 per cent; the part of the whole crop ripe September 15, at which time a frost may usually be expected, and the average weight of a single ripe fruit of each variety computed by weighing a large number of tomatoes and averaging their weight. By taking the per cent of productiveness with the part of the crop ripe September 15, and the average weight of a fruit, a fair comparison of the several varieties may be made. (C) in the table of seedsmen indicates that the variety has been grown here at least one year and that the seed is of our own saving.

TOMATOES.

Variety.	Seedsman.	Date of first ripening	Productiveness. Per cent.	Per cent of crop ripe Sept. 15.	Average weight of a single ripe fruit. Ounces.
Acme	Vaughan (c)	Aug. 15	92	55	7.4
Advance	College	" 11	88	85	4.4
Alexander	Delano Moore	" 8	90	90	5.8
Atlantic	Buckbee (c)	" 12	85	90	6.3
B. B.	Johns'n & Stokes (c)	" 15	85	10	8.0
Beauty	Vaughan (c)	" 15	70	80	8.8
Brandywine	College	" 15	72	20	6.8
Bright & Early	Dreer	" 8	80	45	3 0
Chemin	Thorburn (c)	" 15	75	50	10.6
Conqueror	Thorburn (c)	" 15	85	70	5.2
Crimson Cushion	Henderson (c)	Sept. 4	72	20	13.8
Cross No. 1	Va. Agrl. Col. (c)	Aug. 26	90	40	7.0
Cross No. 2	Va. Agrl. Col. (c)	" 19	84	45	9 4
Cross No. 3	Va. Agrl. Col. (c)	" 19	95	35	8.3
Daybreak	Dreer	" 23	70	25	7.2
Democrat	Thorburn (c)	" 15	90	55	8.2
Dwarf Aristocrat	Buckbee (c)	" 13	96	90	7.6
Dwarf Champion	Vaughan (c)	" 15	65	25	6.4
Favorite	Vaughan (c)	" 15	78	50	9.8
Ferris Wheel	College	Sept. 1	88	20	12.0

TOMATOES.—CONCLUDED.

Variety.	Seedsman.	Date of first ripening.	Productiveness. Per cent.	Per cent of crop ripe Sept. 15.	Average weight of a single ripe fruit. Ounces.
Fordhook	Vaughan (c)	Aug. 18	78	10	6.8
Fortune	Johnson & Stokes	" 27	98	20	8 4
Golden Jubilee	Childs	" 15	88	50	10 2
Golden Queen	Vaughan (c)	" 15	93	70	8.6
Hybrid No. 1	Landreth (c)	" 10	95	55	5.6
Hybrid No. 4	Landreth (c)	" 15	60	55	6.8
Hybrid No. 22	Landreth (c)	Sept. 4	86	20	2 6
Hybrid No. 25	Landreth (c)	Aug. 16	96	20	3 0
Hybrid No. 50	Landreth (c)	" 15	75	85	5.0
Imperial	Maule (c)	" 8	98	50	9.2
Jersey	Landreth (c)	" 15	98	70	6 8
Large Red	College	" 15	98	50	6 5
La Crosse	College	" 15	85	35	7.0
Leader	Vick	" 15	90	75	6 4
Lemon Blush	Thorburn (c)	" 20	65	35	8.3
Liberty Bell	Vaughan (c)	" 23	80	20	6 5
Long Keeper	Vaughan (c)	" 15	70	60	6 0
Miner	A. A. Miner	" 19	100	50	13.2
Minnesota	Dreer	" 8	86	85	4.0
Mixed Red and Purple Cross	Landreth	" 17	88	60	5.4
McCollum's Hybrid	College	" 16	95	35	8.4
Money Maker	Landreth (c)	" 15	100	50	5 4
New Stone	Vaughan (c)	" 8	98	25	10 4
Northern Light	College	" 27	98	25	8.5
Novelty No. 23	Landreth	Aug. 8	99	42	5.4
Novelty No. 24	Landreth	" 15	100	20	1.4
Optimus	College	Sept. 1	93	65	9.6
Perfection	Vaughan (c)	Aug. 15	78	70	8 0
Potato-leaf Ignotum	College	" 27	100	65	12.6
Ponderosa	Henderson (c)	Sept. 4	90	30	11.2
Purple Cross	Landreth	Aug. 15	99	35	5 6
Purple Olive Cross	Landreth	" 20	95	25	4 9
Puritan	Thorburn (c)	" 16	98	50	7.4
Red Cross	Landreth	" 20	96	25	9 2
Ruby	Henderson (c)	" 8	98	80	6 8
Ruby Queen	Childs	Sept. 4	90	5	14.0
Scarlet Cross	Landreth	Aug. 15	95	35	7.4
Seedling	W. Va. Station (c)	Sept. 10	73	5	16 6
Shah	College	Aug. 20	96	65	8.7
Ten Ton	Landreth (c)	" 15	83	65	6.8
Terra Cotta	Thorburn (c)	Aug. 19	98	50	6 4
Thorburn	Thorburn	" 8	88	20	7.8
Three Celled Cross	Landreth	Sept. 10	94	5	4.8
Tomato No. 105	Johnson & Stokes	Aug. 8	98	40	8.6
Tom Thumb	College	" 8	88	60	4.0
Tree Tomato	Buckbee (c)	" 15	85	15	4 8
Turner Hybrid	Vaughan (c)	" 27	92	45	12.0
Upright Station	Thorburn (c)	Sept. 1	85	15	4 3
Virginia Corker	Landreth	" 7	74	25	8.8
Volunteer	Vaughan (c)	Aug. 15	65	35	10 4
Buckeye State	Vaughan (c)	" 27	98	85	9.8

NOTES ON VARIETIES.

The following are sorts but recently introduced:

Alexander, Delano Moore, Presque Isle, Maine. Plants similar in mode of growth to Advance, but the leaflets are larger and have not the grayish tinge. Fruit varies from round flattened to ovate flattened, or often quite irregular; size, small to medium; colors very evenly a bright,

deep red; flesh, a deep red of fine grain and good quality. Of the Earliest type, but more even in size and regular in form. Valuable for extreme earliness, good color, form and quality. Does not crack or rot and is a very productive sort.

Bright and Early, Henry A. Dreer, Philadelphia. Plant and plant growth closely like Advance, though perhaps slightly more erect in habit. Fruit exactly similar to Advance in form but will not average as large in size; the color of the skin is more of a golden yellow, due to the larger size and more numerous yellow dots on the surface. A few fruits were ripe before those on Advance, but the general crop was later and the plants were less productive.

Daybreak, Dreer. Plants are not of strong growth, rather upright in habit; foliage of Acme type, but the leaf stalk is larger, and marked by having numerous small, pointed leaflets between larger ones. Fruit closely of Ignotum type but the cell walls are thicker and the angles more prominent. Not as productive as most sorts.

Fortune, Johnson & Stokes, Philadelphia. Plants of an upright habit of growth, but so vigorous that they spread over a large amount of space. Foliage of Acme type, but the leaflets are larger and more deeply cut. Fruit closely resembles Ignotum in form and color, but has thicker flesh walls and the skin is tougher. It is also later in ripening.

Golden Jubilee, John Lewis Childs, Floral Park, N. Y. Plant growth low down, straggling; leaflets large and coarse. The fruits are large, round or ovate, often somewhat angular; flesh walls thick; cells small and numerous; color a bright yellow often with green streaks running from base to apex, considerable green around base. Fruits are a deeper yellow and flesh much more solid than Golden Queen. The plants are productive and all the fruits are large, but are often scabby at apex and cracked around base.

Leader, James Vick's Sons, Rochester, N. Y. Plant of low, straggling growth; foliage, light green; leaflets, small, close set, partly curled. Fruits of fair size, quite irregular and angular. While the first ripening was not so early as some others, the bulk of crop was ripe at an early date. Quite closely of Earliest type of fruit, though scarcely so early, and tomatoes are more angular, too much so to sell well in market.

Miner, A. A. Miner, Luther, Mich. Plants of largest growth; foliage of Potato Leaf type. Fruit closely resembles Turner Hybrid, though scarcely so thick and the apex is more depressed. One of the most productive sorts in the field, and the fruits will average larger in size than Ponderosa though scarcely so regular. Flesh solid and of good quality. An excellent tomato.

Minnesota, Dreer. Plants of low, straggling growth; foliage of Ignotum type, but the leaflets are smaller and slightly curled. Fruits closely resemble those of Dwarf Champion, though the cell walls are more prominent, making small angles. Flesh bright red and of good quality. The variety is very productive and one of the best early ripening sorts, bearing small to medium sized fruits.

Novelty No. 22, D. Landreth & Sons, Philadelphia. Plants of strongest growth; foliage closely like that of Acme, though the leaflets are farther apart and the texture more papery. Fruit medium in size, spherical in general outline, deep from base to apex, the color varies from purplish red to bright red with golden dots; flesh of good color and quality. The plants are very productive, and while many fruits are small the large crop

borne gives a fair yield of good fruits. We hope by selection to improve the variety.

Novelty No. 24, Landreth. The fruits are of Plum type and too small in size to be of commercial importance.

Thorburn, J. M. Thorburn & Co., New York city. Plants are of strongest growth and lie close to the ground; the foliage is of Acme type but with fewer leaflets and are farther apart on leaf stalk. Fruits are of good size, varying in form from round to ovate; color light purplish red with yellowish streaks; flesh dark color, solid and of good quality. A distinct sort. Type not fixed.

Tomato No. 105, Johnson & Stokes. Plants of very vigorou r foliage of Acme type, but the leaflets are a lighter green and vary greatly in size, and fruits vary much in form and size, but their general outline is of the Ignotum type; the color varies from a light, bright red to Acme color; flesh of excellent quality. Type not fixed. Nearly all the fruits produced are of good, marketable size. Seed has been selected to improve and fix the red type.

Virginia Corker. Landreth. Plants of largest growth; foliage of Acme type, but the leaf stalks are longer and leaflets larger and farther apart. Fruit of Ignotum form and color, though scarcely so regular in general outline. The bulk of crop was late in ripening.

Landreth's Cross-Breds. Several varieties of tomatoes were sent out by D. Landreth & Sons, of Philadelphia, under the name of Cross-Breds. While the type of many of these is not fixed, there are several sorts that have much promise. Careful selections were made of the best fruits of the better kinds, and an effort will be made to fix and improve them.

Of the sorts grown for one or more seasons, the following are worthy of special attention:

Dwarf Aristocrat is a sort resembling Dwarf Champion in plant growth, but the fruits are larger in size, and of a bright red color. The plants are more productive than Dwarf Champion, and ripened a much larger proportion of the crop. Like Dwarf Champion, it ripens a few fruits quite early and the bulk considerably later, yet, from the larger size of the fruits and the greater plant productiveness, it is to be preferred to that well-known variety.

Potato-leaf Ignotum. Several years ago a plant was noticed in the Ignotum patch having foliage resembling Turner Hybrid, while the fruit was similar to that on neighboring plants of Ignotum. Seed was saved from fruits of this plant, and by careful selection a new variety has been secured. The fruits are quite like Ignotum in form, but they are larger in size, and the flesh is a trifle coarser and more solid at center. The plants are very productive and ripen the greater part of the crop quite early in the season. A very desirable sort.

Terra Cotta. This variety is unique in form and in color of skin, and in the deep, rich color of flesh, and has been greatly improved in size of fruits by careful selection of seeds. It is an excellent sort for home use, but, on account of the thin skin and tender flesh, will not carry well to market.

Ignotum. For several seasons this variety has been the one grown for the general crop. The fruits are large, of good form and quality. The plants are productive, and ripen a good proportion of the crop before frost comes. The following sorts are closely of Ignotum type of fruit, though

differing slightly in color and form, in appearance of plant and time of ripening:

B. B., Brandywine, Favorite, Liberty Bell, McCollum, New Stone, Optimus, Perfection, Ten Ton and Volunteer.

Acme. This is one of the best sort for market, where purple tomatoes are desired. The plants are productive and ripen the purplish red fruits quite early in the season.

Beauty, Imperial, Long Keeper and Buckeye State are quite similar to Acme, though slight differences, mark the varieties.

Ponderosa. This sort, though late in ripening, bears very large fruits, having a flesh somewhat coarse in texture but of good quality. If one desires a variety bearing large, solid tomatoes that are good keepers, Ponderosa would give satisfaction. Ferris Wheel and Crimson Cushion are much like Ponderosa.

SUMMARY OF VARIETIES.

Vaughan's Earliest is one of the best early ripening sorts, though the new selection, Alexander, has shown up remarkably well and may crowd it for first place.

Advance is a little later than Earliest, but the fruits are smooth and more regular in form.

Ruby and *Atlantic Prize* are recommended as early ripening sorts having fruits of good marketable size.

Acme, *Beauty*, *Ignotum*, *Perfection*, *Potato-leaf* and *Optimus* are named as excellent sorts for the general crop.

Miner and *Ponderosa* bear very large solid fruits, but the time of ripening is rather late.

AGRICULTURAL COLLEGE, MICH.,
February 15, 1897.

REPORT OF FARMERS' INSTITUTE WORK.

FOR SEASON OF 1896-97.

BY KENYON L. BUTTERFIELD, SUPERINTENDENT OF INSTITUTES.

The work of the second season, ending June 30, 1897, under the present Institute law, was in the main extremely satisfactory. In but a few cases was there lack of interest in planning the Institutes, and in many instances there was manifested positive enthusiasm. In fact the general sentiment among the farmers was of the warmest friendliness toward the work.

The attendance was satisfactory as compared with the previous year; yet there is room for improvement in this respect. Lack of advertising probably had something to do with this.

The details of our work have been much improved. Fewer subjects on the program and consequently more time for discussion, greater promptness in carrying out the program, better advertising, and in general a better management of the whole Institute, have, we believe, characterized our Institutes this year as compared with last.

OUR OBLIGATIONS.

Too much credit cannot be given to the many earnest officers of Institute societies, some of whom devoted days and even weeks of valuable time to making the Institutes a success.

Our thanks are also due the newspaper fraternity in general for their public spirit in advertising and reporting the Institutes. With hardly an exception they gave freely of their space, and were a strong factor in the success of the meetings.

We are also under the greatest obligations to the railroads of the State for their grant of half rates to our workers, and for the uniform courtesy and promptness with which their business relations with us have been characterized.

CONFERENCE OF INSTITUTE WORKERS.

November 20, 1896, all of the Institute lecturers employed by the Board of Agriculture met at the College for a conference upon subjects connected with the details of Institute work. It was voted a most valuable meeting, and unquestionably told materially upon the character of the work we were able to furnish the people during the winter following. The following program will show the scope of the conference:

PROGRAM OF CONFERENCE OF MICHIGAN FARMERS' INSTITUTE WORKERS, AGRICULTURAL COLLEGE, FRIDAY, NOVEMBER 20, 1896.

Afternoon, Agricultural Laboratory.

1:45—Introductory, Hon. C. J. Monroe, President of the Conference.
2:00—Model lecture, Prof. Clinton D. Smith.
2:20—Model discussion, carried on by workers.
3:00—Criticisms and comments on the above.
3:15—Brief discussions on the following topics:
1. Illustrating lectures, Dr. W. J. Beal.
2. Adapting lectures to locations, Prof. L. R. Taft.
3. How to draw out discussion from the farmers, Hon. Wm. Ball.
4. State workers aiding in discussions, Mr. Roland Morrill.

3:45—The duties of the conductor, Hon. Chas. W. Garfield.
General discussion.

Evening, College Chapel.

7:00—Miscellaneous topics for ten minute discussions:
1. The question box, Mr. R. M. Kellogg.
2. Getting acquainted with the farmers, Mr. I. N. Cowdrey.
3. Women's sections, Mrs. Mary A. Mayo.
4. Advertising M. A. C. and Experiment Station, Prof. C. D. Smith.
5. Granges and Farmers' Clubs, Hon. Chas. W. Garfield.
6. Railroad and hotel rates, and accounts, the Superintendent.

8:00—Institute principles and practices in several states, Kenyon L. Butterfield.
Discussion.

ANNIVERSARY MEETINGS.

January 11-12, 1876, were the dates of the first Farmers' Institutes held in Michigan, Allegan and Armada both having meetings at that time. It was thought fitting to celebrate the coming of age of the work by special exercises. Allegan and Armada were without difficulty induced to hold their Institutes this year on these dates (Armada preferring the 12th and 13th), and each devoted an evening to an anniversary meeting. At Allegan, Dr. R. C. Kedzie read a valuable paper on the "Starting of the Farmers' Institutes." At Armada, Dr. W. J. Beal read a paper on "Twenty-one Years of Institute Work." These papers were peculiarly felicitous, from the fact that Dr. Kedzie attended the Armada meeting in 1876, and Dr. Beal was on the Armada program at the same time, although detained from the meeting by sickness. Both men have performed Institute work continuously ever since.

THE LONG INSTITUTES.

The four-day Fruit Institute held at Shelby, Oceana county, was a success, and demonstrated afresh the value of what we term the "Long Institute." The three-day Dairy Institute held at Hastings was not a success in point of attendance, but the program gave good satisfaction. A glance at the program of these two Institutes will show the scope and plan of the work attempted.

PROGRAM—LONG FRUIT INSTITUTE.

AT SHELBY, OCEANA COUNTY, DECEMBER 15, 16, 17, 18, 1896.

HON. CHAS. W. GARFIELD, CONDUCTOR.

Tuesday, December 15—Forenoon.

10:00—"Peaches and Plums; Locating and Planting the Orchard"..Roland Morrill
11:00—"Forecast of Frosts"....................................Dr. R. C. Kedzie

Afternoon.

1:00—"Diseases of Small Fruits"..............................Prof. L. R. Taft
2:00—"The Relation of Bees to the Fertilization of Flowers"..Prof. W. B. Barrows
3:00—"Water in Physics"..............................Prof. P. B. Woodworth

Evening.

7:00—Address of Welcome..................................F. W. VanWickle
Response ....Hon. C. W. Garfield
7:30—Discussion of Road Question, conducted by Hon. F. J. Russell. Papers by Geo. C. Myers and B. S. Garver.

Wednesday, December 16—Forenoon.

10:00—"Peaches and Plums; Cultivation and Care"...............Roland Morrill
11:00—"The Simpler Chemistry of the Soil"......................Dr. R. C. Kedzie

Afternoon.

1:00—"Diseases of Pome Fruits"..............................Prof. L. R. Taft
2:00—"A few Insect Enemies of the Apple and Pear".......Prof. W. B. Barrows
3:00—"Water in the Air"............................Prof. P. B. Woodworth

Evening.

7:30—"Is our Present School System too Expensive?"........Dr. R. G. Cavanagh
"Practical Education vs. Theoretical Teaching"..........Hon. J. F. Widoe
"How Much Should the Country School Teach?"........F. W. VanWickle

Thursday, December 17, Forenoon.

10:30—"Peaches and Plums: Marketing"..........................Roland Morrill
11:00—"Soil Exhaustion"......................................Dr. R. C. Kedzie

Afternoon.

1:00—"Diseases of Stone Fruits"..............................Prof. L. R. Taft
2:00—"Some Insects Attacking Peaches and Plums"......Prof W. B. Barrows
3:00—"Water in the Soil"............................Prof. P. B. Woodworth

Evening.

7:30—Topic, "The Farm Home," conducted by Major G. W. Woodward. Papers by Mrs. T. S. Gurney and Frank Evans.

Friday, December 18—Forenoon.

9:00—Business Meeting.
10:00—"Peaches and Plums: Varieties"........................Roland Morrill
11:00—"Feeding the Soil"....................................Dr. R. C. Kedzie

Afternoon.

1:00—"Treatment of Plant Diseases"...........................Prof. L. R. Taft
2:00—"The Natural Enemies of Insects"....................Prof. W. B. Barrows
3:00—"Water in Plants"..............................Prof. P. B. Woodworth

Lectures will be thirty minutes long. A general discussion will follow each lecture.

Both the day and evening programs will be interspersed with good music.

PROGRAM—LONG DAIRY INSTITUTE.

AT HASTINGS, BARRY COUNTY, DECEMBER 15, 16, and 17, 1896.

PROF. C. D. SMITH, CONDUCTOR.

All the State speakers were from the Agricultural College, except Mr. A. M. Welch, Ionia.

Tuesday, December 15—Forenoon.

10:00—"The Place of the Dairy on the Michigan Farm"..........Prof. C. D. Smith
11:00—"Combined use of the Babcock Test and the Observation of Dairy Form in the Selection of Cows"..........................Mr. G. H. True

Afternoon.

1:00—"Shall we Buy or Raise our Cows?"........................Mr. A. M. Welch
2:00—"Stall Fixtures" ....Prof. C. D. Smith
3:00—General Discussion and Question Box on the above topics.

Evening.

7:00—Local Program..Miss Flora Beadle, Commissioner of Schools, Barry County
8:00—"Dairy Chemistry," Illustrated with Stereopticon........Prof. F. S. Kedzie

Wednesday, December 16—Forenoon.

10:00—"The Principles of Stock Feeding"....................Prof. C. D. Smith
11:00—"Silo Construction"...Mr. A. M. Welch

Afternoon.

1:00—Business Meeting, Election of Officers, etc.
1:30—"Feeding the Herd in Dry Years"..........................Mr. G. H. True
2:30—"Growing the Silage and Filling the Silo"................Mr. A. M. Welch
3:30—"Discussion and Question Box on Feeding and Care of Dairy Stock.

Evening.

7:00—"Local Program.
8:00—"Dairy Bacteriology," Illustrated with Stereopticon......Mr. C. E. Marshall

Thursday, December 17—Forenoon.

10:00—"Winter Feeding, with and without Silage"................Mr. A. M. Welch
11:00—"The Home Dairy vs. the Factory"........................Prof. C. D. Smith

Afternoon.

1:00—"The Art of Butter Making"..................................Mr. G. H. True
2:30—A General Discussion of the Subject of Butter Making.

Lectures will be about 30 minutes long, and full discussion will follow each lecture.

This Institute is designed to cover all phases of dairying applicable to this vicinity. In order to get the best of the Institute, it is necessary that those interested should be present every day of the sessions.

THE ROUND-UP.

Pursuant to the general policy of the Board of Agriculture in moving Institutes from place to place, the Round-up was this year held in St. Louis, Gratiot county. The local arrangements were well attended to. The attendance was considerably larger than at Grand Rapids, but the number from outside the county was considerably smaller. A woman's section was held each afternoon.

One of the most profitable features of the gathering were the conferences held. Each morning of the meeting there was held a conference of Institute lecturers, to discuss the lessons of the winter's work. Each afternoon after the session of the Institute the officers of county Institute societies who were present held a conference to discuss methods of advertising, preparing programs, and similar topics. Great good resulted from these conferences, and we regretted that there were not more Institute society officers present to enjoy and profit by them.

PROGRAM OF SECOND ANNUAL MICHIGAN ROUND-UP FARMERS' INSTITUTE,

HELD AT ST. LOUIS ON MARCH 2, 3, 4, 5, 1897, UNDER THE LOCAL AUSPICES OF THE

GRATIOT COUNTY FARMERS' INSTITUTE SOCIETY.

Tuesday Morning, March 2.

Arrangement of Exhibits.

Tuesday Afternoon.

1:20—Welcome ....Mayor Crandall, St. Louis
Response.....................................Hon. C. J. Monroe, South Haven
2:00—"Green Manuring"..................Mr. A. A. Crozier, Agricultural College
2:30—"Discussion, led by.........................A. E. Palmer and E. A. Croman
3:00—"An Improved Farm Barn"......Mr. John L. Shawver, Bellefontaine, Ohio
3:30—Discussion.
4:30-5:30—Conference of officers and delegates of County Farmers' Institute Societies.

Tuesday Evening.

7:00—Musical program.
7:30—"Bacteria and Their Importance in Every-day Life," illustrated with stereopticon....................Mr. C. E. Marshall, Agricultural College
8:30—"Prevention and Restriction of Communicable Diseases"....................Dr. Henry B. Baker, Secretary State Board of Health

Wednesday Morning, March 3—Young Men's Session.

9:15-9:45—Conference of Farmers' Institute lecturers.
10:00—"Improving and Utilizing Low Lands"....Mr. C. B. Charles, Van Buren Co.
10:30—Discussion.
11:30—"Making Butter in a Dairy of Less than Five Cows"....................Mr. G. H. True, Agricultural College
11:30—Discussion, led by..........................J. H. Brown and E. A. Croman

Wednesday Afternoon.

1:30—"Recent Progress in Stock Feeding"..Prof. C. D. Smith, Agricultural College
2:00—Discussion, led by............................A. M. Welch and Wm. Ball
2:30—"Sugar Beet Raising in Michigan"....Dr. R. C. Kedzie, Agricultural College
3:00—Discussion, led by....................................Prof. C. D. Smith
3:45—Question Box.
4:30-5:30—Conference of officers and delegates County Farmers' Institute Societies.

Wednesday Evening.

7:00—"Flowers, Their Influence on Rural Life"....................Mr. Thomas Gunson, Agricultural College
7:25—Discussion.
7:45—"Home Life on the Farm"................Mrs. Mary A. Mayo, Battle Creek
8:10—Discussion.
8:30—"The Surroundings of the Farm Home"....................Hon. Charles W. Garfield, Grand Rapids

Thursday Morning, March 4.

9:15-9:45—Conference of Farmers' Institute lecturers.
10:00—"Pruning, its Objects and its Limitations"..Mr. R. M. Kellogg, Three Rivers
10:30—"Discussion, led by Prof. L. R. Taft, Hon. R. L. Taylor and Mr. M. L. Dean.
11:00—"Business Methods in Farming"........Mr. Roland Morrill, Benton Harbor
11:30—Discussion, led by...Hon. Wm. Ball

Thursday Afternoon.

1:30—"Does Improved Stock pay the Average Farmer To-day?"....................Hon. Wm. Ball, Hamburg
2:00—Discussion, led by Prof. H. W. Mumford and Sec'y I. H. Butterfield, Agricultural College.
2:30—"The Forestry Problem in Michigan"..Dr. W. J. Beal, Agricultural College
3:00—Discussion, led by....................................Hon. Chas. W. Garfield
3:30—Question Box.
4:30-5:30—Conference of officers and delegates of County Farmers' Institute Societies.

Thursday Evening.

7:00—"Some Observations on the Old and Noted Fruit Districts of Delaware, Maryland and New Jersey"........Hon. C. J. Monroe, South Haven
7:30—Discussion.
8:00—"Practical Education"..............Pres. J. L. Snyder, Agricultural College
8:30—Discussion.

Friday Morning, March 5.

9:00-9:30—Conference of Farmers' Institute lecturers.
9:30—"Smuts and Rusts of Grain"......Prof. C. F. Wheeler, Agricultural College
10:00—Discussion.
10:30—"The Essentials of Profitable Apple Growing in Michigan"......
....Mr. J. N. Stearns, Kalamazoo
11:00—Discussion, led by...........................A. P. Gray and H. P. Gladden
11:30—Business meeting of the Gratiot County Farmers' Institute Society.

Friday Afternoon.

1:00—"Some Insects of the Orchard and Garden"......................
..............................Prof. W. B. Barrows, Agricultural College
1:30—Discussion.
2:00—"Structure of the Milk Glands of the Cow, and Diseases Peculiar to Them"
................................Dr. E. A. A. Grange, Agricultural College
2:30—Discussion, led by................Sec'y I. H. Butterfield and A. M. Welch
3:00—Question Box and farewell meeting.

WOMEN'S SECTION—HELD IN PRESBYTERIAN CHURCH.

CONDUCTOR—MRS. MARY A. MAYO.

Tuesday Afternoon.

1:30—Demonstration lecture in cooking................................
...........................Prof. Edith McDermott, Agricultural College
3:30—"Some Points for Women who Make Butter"......................
................................Mr. G. H. True, Agricultural College
3:45—Discussion, led by......................................Mrs. J. E. Long
Question Box.

Wednesday Afternoon.

1:30—Demonstration lecture in cooking...................Prof. Edith McDermott
3:30—"Poultry Raising for the Farmers' Wife"..............Mrs. Mary A. Mayo
3:45—Discussion, led by..................................Mrs. George Abbott
Question Box.

Thursday Afternoon.

1:30—"Some Things we Farmers' Wives Need"........................
....Mrs. Mattie A. Kennedy, Muskegon County
2:00—Discussion, led by...Mrs. Otto Mey
2:30—"Mother and Daughter"...............................Mrs. Mary A. Mayo
3:00—Discussion, led by.............................Mrs. N. B. Jones, Lansing
Question Box.

Friday Afternoon.

1:30—"The Ideal Home".............................Mrs. L. W. Bliss, Saginaw
2:00—Discussion, led by...................................Mrs. Stiles Kennedy
2:30—"Being a Helpmeet"..........Mrs. Mattie A. Kennedy, Muskegon County
3:00—Discussion.
Question Box.

ONE-DAY MEETINGS.

The experience of last season convinced us that the chief fault of our Institute system is the simple fact that it does not reach as many people as it should; it oftentimes does not reach the very people who most need its influence. This can be truly stated without in the least reflecting on the management of any one Institute. The very fact that but one Institute is held in a county each year, the added fact that every Institute draws the bulk of its attendance from a distance not to exceed five miles, makes it simply impossible for us to cover a county under the present plan. How to obviate this weakness without enormously increasing the cost is the problem. It occurred to us that the solution might lie along the line of supplementing the regular county meeting with a series of one-day meetings, scattered about the county, chiefly in localities unlikely to obtain the regular county meeting for at least some years. To demonstrate either the value or worthlessness of such a plan, we determined upon an experiment in two counties. We chose Ionia and Sanilac counties, securing without difficulty the hearty coöperation of the officers of the Institute societies in both counties. Five one-day meetings were held in each county, as follows:

In Ionia county—Portland, Monday, January 18; North Plains, Tuesday, January 19; Belding, Wednesday, January 20; Clarksville, Thursday, January 21; Lake Odessa, Friday, January 22.

The county meeting followed the next week at Ionia.

In Sanilac county the meetings were—Brown City, Tuesday, February 1; Sanilac Center, Wednesday, February 2; Argyle, Thursday, February 3; Minden City, Friday, February 4; Port Sanilac, Saturday, February 5.

The county meeting was held at Croswell the week following.

But one State speaker was sent, in each case Hon. Wm. Ball being the lecturer requested. The programs were like the usual Institute program. In Ionia county the secretary personally made local arrangements at each point, with the aid of vice presidents and committees. At the time of holding the Institutes both the president and secretary attended each meeting. In Sanilac county the local arrangements were made through a sub-society at each point. The table below will give an idea of the value of the experiment.

SYNOPSIS OF INSTITUTE WORK IN IONIA COUNTY, 1896 AND 1897.

1896.

One-day meeting at Ionia; average attendance per session, 435.

1897.

There was held one three-day "County Round-up" at Ionia, with 332 average per session;

Also five one-day meetings, as follows:

Place.	Sessions.	Total attendance.	Average per session.
Portland	3	780	260
North Plans	2	225	113
Belding	3	885	295
Clarksville	3	600	200
Lake Odessa	3	570	190
Total		3,060	1,058

Average attendance per session for these five meetings.................... 212
Average attendance per session at 68 Institutes, 1895-6.................... 223

The extra cost to the State of the five one-day meetings was $27.00, or approximately $5.50 per meeting.

SYNOPSIS OF INSTITUTE WORK IN SANILAC COUNTY, 1896 AND 1897.

1896.

Held a two days' meeting at Sanilac Center, average attendance per session 200.

1897.

Held a three days' "County Round-up" at Crosswell, average per session 318.
Also five one-day meetings as follows:

Place.	Sessions.	Total attendance.	Average per session.
Brown City	3	775	255
Sanilac Center	2	225	108
Argyle	2	300	150
Minden City	2	275	137
Port Sanilac	3	425	162
Total		2,000	812

Average per session for the five one-day meetings.......................... 162

The extra cost to the State was $37.00, or approximately $7.50 per meeting.

The work was eminently satisfactory to the people in these counties, so far as we could ascertain.

Our own opinion is that we have solved the problem; that a combination plan of holding five or six one-day meetings in a county, and following later with a longer county meeting, is almost ideal. We believe that with $1,000 extra appropriation per year we can hold at least 100 one-day meetings each winter, and thus nearly double our efficiency.

WOMEN'S SECTIONS.

A women's section was held in connection with 56 Institutes the past season; at seven others the State furnished a lady speaker for the regular sessions. At most Institutes where women's sections were held the lady speaker sent by the State to conduct the women's section also appeared on the general program. While in a few instances there have been objections to the separate sessions for women, the general sentiment, especially among the women themselves, is heartily in favor of a continuance of the women's sections. The following shows the places where women's sections were held, and the attendance:

Women's Sections at Farmers' Institutes, Winter of 1896-97.

County.	Place.	Attendance.	County.	Place.	Attendance.
Alcona	Harrisville	47	Lake	Chase	83
Allegan	Allegan	106	Lapeer	Lapeer	211
Alpena	Alpena	116	Lenawee	Adrian	225
Antrim	Mancelona	35	Livingston	Howell[1]	
Arenac	Standish[1]		Macomb	Armada	200
Barry	Hastings		Manistee	Copemish	66
Bay	Auburn	67	Marquette	Marquette[1]	
Benzie	Benzonia	48	Mason	Scottville	48
Berrien	Niles	80	Mecosta	Morley	36
Branch	Coldwater	350	Menominee	Stephenson[1]	
Calhoun	Albion	250	Midland	Midland	80
Cass	Cassopolis	250	Missaukee	Lake City	32
Charlevoix	East Jordan	32	Monroe	Monroe	72
Cheboygan	Cheboygan	6	Montcalm	Carson City	116
Chippewa	Sault Ste. Marie	52	Muskegon	Muskegon	96
Clinton	St. Johns	56	Newaygo	Fremont	92
Crawford	Grayling		Oakland	Milford	150
Dickinson	Norway[1]		Oceana	Shelby	
Eaton	Charlotte	122	Ogemaw	Rose City	68
Emmet	Harbor Springs	45	Osceola	Hersey	46
Genesee	Flushing	225	Oscoda	Mio	
Gladwin	Gladwin	60	Otsego	Gaylord	72
Grand Traverse	Traverse City	55	Ottawa	Holland	33
Gratiot	St. Louis	[2] 1,125	Roscommon	Roscommon	52
Hillsdale	Hillsdale	78	Saginaw	Chesaning	125
Huron	Bad Axe	160	Sanilac	Croswell	250
Ingham	Stockbridge	350	Shiawassee	Laingsburg	175
Ionia	Ionia	450	St. Clair	Emmet[1]	
Iosco	Tawas City	58	St. Joseph	Three Rivers	400
Iron	Iron River[1]		Tuscola	Vassar	122
Isabella	Mt. Pleasant	99	Washtenaw	Chelsea	350
Jackson	Brooklyn	220	Wayne	Plymouth	350
Kalkaska	Kalkaska	40	Wexford	Sherman	44
Kent	Grand Rapids	150			

NOTE.—Total attendance, 8,326; average per session, 141.

[1] To these places the State sent a lady speaker, but no separate women's section was held.
[2] Four sessions.

COLLEGE EXTENSION

was another line of work undertaken during the year. We arranged with Mr. Roland Morrill, of Benton Harbor, to give a series of lectures in Allegan county on the subject of "Peach Culture." We believed that by this plan of lectures we could reach people more completely and do more good than could be done at a Farmers' Institute, valuable as an Institute is. Believing this, we desired to experiment a little to find out if our theory was worth anything.

The general topic was that of "Peach Culture." The idea was to give three lectures at each point on this topic; lecturing the same day of the week at each place, for three weeks in succession. Mr. Morrill divided the topic as follows:

1. "Location of orchard and the selection and planting of trees."
2. "Cultivating, pruning, fertilizing, etc." (This lecture was illustrated with stereopticon.)
3. "Harvesting, marketing, and varieties."

We arranged for meetings at the following places and dates:

Shelbyville, Wednesday, March 10. March 17. March 24.
Wayland, Thursday, March 11. March 18. March 25.
Moline, Friday, March 12. March 19. March 26.
Otsego, Monday, March 15. March 22. March 29.
Martin, Tuesday, March 16. March 23. March 30.

Lectures began at 7:00 p. m. except at Moline, where they began at 2:00 p. m.

These lectures were advertised as absolutely free to everyone wishing to attend. Mr. Morrill was taken about from place to place, to visit orchards in each locality, and entertained en route. Any expense connected with this was provided for locally. Otherwise we paid expenses. We also endeavored to secure regular classes at each point, to take notes and read during the week. During the day time Mr. Morrill visited various orchards in the vicinity of the places of the lectures.

Mr. E. J. French, Otsego, secretary of the County Institute Society, had general charge of arrangements for these meetings, and the following gentlemen took immediate local charge of the meetings: Shelbyville, T. G. Adams; Wayland, C. A. Clark; Moline, F. C. Gilbert; Otsego, Geo. D. Higgins; Martin, R. Johnson.

Another series was arranged for in Oakland county, for farmers' wives, on the same general plan as that pursued above. Mrs. Mary A. Mayo, of Battle Creek, was chosen for this work.

The general theme of Mrs. Mayo's talks was along the line of the talk which she gave at many Farmers' Institutes on "Mother and Daughter." The topic was divided into three, and one topic was presented each afternoon.

1. "The House We Live In."
2. "Wifehood and Motherhood."
3. "Mother and Children."

We arranged the following dates for Mrs. Mayo:

Highland—Tuesday, March 9. March 16. March 23.
Milford—Wednesday, March 10. March 17. March 24.
Wixom—Thursday, March 11. March 18. March 25.
Novi—Friday, March 12. March 19. March 26.

The meetings were held at two o'clock in the afternoon.

Mr. A. C. Bird, of Highland, very kindly gave much time to arranging the details of the work, and the following ladies also contributed largely to the arrangements: Highland, Mrs. Harrison; Milford, Mrs. McCall; Wixom, Mrs. Sibley; Novi, Mrs. Hazen.

Unfortuately the whole three weeks proved the muddiest time of year, the last week the roads being almost impassable. Yet the attendance was fair and the interest good. In both counties the verdict of the people, as far as we can learn it, is "it is a good work, and we favor its continuance." The attendance was as follows. Mr. Morrill's second and third meetings were combined at Otsego, Martin and Moline:

	1st	2d	3d
Otsego	34	41	..
Martin	30	26	..
Shelbyville	22	36	12
Wayland	40	52	42
Moline	50	46	..

	1st	2d	3d	Evening.
Highland	22	44	41	
Milford	77	67	50	150
Wixom	33	25	37	85-87 (2 eve.)
Novi	47	92	85	..

CO-OPERATIVE EXPERIMENTS.

The experiments outlined on page 312 of last year's Institute bulletin were carried out by numerous farmers, but no reports were made in shape for publication. The work was of some value, however, and in many cases was reported at the county Institute. We believe that there is opportunity for some good work along this line. This year, however, we are offering no experiments.

EXHIBIT AT STATE FAIR.

The prizes for exhibits by County Institute Societies at the Michigan State Fair of 1896 were not competed for, and will probably not be offered this year.

AGRICULTURAL SURVEYS.

Believing that a better knowledge of the resources of the upper peninsula, so far as agricultural prospects are concerned, would remove some of the prejudice that exists in the minds of many people against that part of the State, we asked Prof. Wheeler and Hon. Wm. Ball, two of the lecturers who attended the Institutes in the upper peninsula, to

spend a day in each county visited, and so far as they could in the limited time, to observe the natural agricultural conditions. The counties visited were Marquette, Iron, Dickinson, and Menominee. Of course the work was more or less superficial. But Prof. Wheeler has studied the botany and geology of the whole region, and speaks from the scientist's standpoint. Mr. Ball is a close observer, and a successful farmer, and speaks from that standpoint. We therefore present their reports, as being valuable contributions to the knowledge of the resources of our State. The visits were made in late September.

PROF. WHEELER'S REPORT.

Superintendent of Farmers' Institutes:

DEAR SIR—According to your directions, one day during each of the Farmers' Institutes held in September, 1896, at Marquette, Iron River, and Norway, was spent in making a preliminary examination of the soil and forest conditions in the vicinity of the places named. The following report is respectfully submitted:

The extent of the upper peninsula of Michigan from east to west is about 318 miles; width, 30 to 164 miles, forming about two-fifth of the State. The general elevation is 400 to 1,100 feet above Lake Superior. A line drawn from the city of Marquette south and west to the mouth of the Sturgeon river divides the peninsula into two unequal sections, which present very marked surface and geological contrasts. The eastern portion is underlaid with sandstones and limestones. These lie in a horizontal position, making the floor of the level country to be found from Sault Ste. Marie westward. These plains slope gradually northward from the southern borders to a watershed and thence fall rapidly to the shores of Lake Superior. This portion of the State contains many lakes and marshes, and a few fine forests of mixed pine and hardwood remain. The principal portion of the agricultural lands is to be found in this section. The western portion is in marked contrast with the eastern. Here are the iron and copper areas covered with the oldest known rocks, which have been tilted up at various angles by volcanic action, forming a rugged, broken surface, with little agricultural land except in the southwestern portion.

MARQUETTE COUNTY.

The soil in Marquette county is a mixture of the pulverized red sandstones lying along the lake shore and the drift brought from the north and eastward. South and east of the city of Marquette the soil is light and sandy. A part of Chocolay and West Branch townships was examined. The trees and shrubs along the first part of the route were those common to the light, sandy plains of northern Michigan, viz.: Three species of poplar, the American aspen, the large-toothed aspen, and the balsam poplar, named in the order of size and value; small, paper, or canoe birches, pin cherries, jack pines, white and Norway pines, hemlocks, white spruce, balsams and arbor-vitæ, with occasionally a stunted red oak and red maple.

Entering Chocolay township the land begins to improve in quality, due to the limestone rocks which underlie the soil south of the lake shore. The whole of this part of the route shows the destructive effect of lumbering operations, followed by forest fires, leaving a dreary, blackened ruin, which, however, is relieved at this season of the year by the most brilliant autumn colors of maples, poplars, birches, pin cherries, set against the greens of numerous white spruces, pines and hemlocks.

The deciduous trees in the township of West Branch became larger in size and more numerous. The pin cherries and poplars give place to large, fine sugar maples, basswoods, cherry birches, elms, and large hemlocks. Comfortable farmhouses now become more frequent, the clearings are larger and young orchards are planted generally. The soil continues to improve as we pass southward along the Chocolay river. The farms are more numerous, better buildings, better crops of spring wheat, oats, barley, peas, potatoes, and even some fields of corn are seen. The best timber is seen on Sec. 12. Here is a thrifty Swedish settle-

ment named Yalmar. Here the party stopped for dinner at the hospitable home of Mr. Gustav H. Bahrman, who has well cleared fields and good crops. Mr. Bahrman has in operation a portable sawmill. In the neighborhood is a comfortable Lutheran church, and a good sized schoolhouse. Here are evidences of prosperity which compare well with many communities in lower Michigan.

IRON COUNTY.

The soil conditions in Iron county are entirely different from those in Marquette county. Here the surface is underlaid with granite, in which occurs the iron bearing series of rocks, so that the hills may be said to be literally full of iron. The soil which covers these rock masses and the multitude of hard-head boulders scattered about, is a fine sandy loam of good quality and everywhere alike in composition, which seems to show that it must have been derived from the Mississippi valley waters after glacial times. This soil is very finely divided, of a rich brown color, and is easily cultivated. A portion of four townships lying east and north of the village of Iron River was examined. The country is much broken, being traversed by a series of hills and valleys lying between Iron river and Paint river. In many places the hillsides are very stony.

On the hills is a fine growth of sugar maple, the most abundant of all the forest trees in this part of the country; next in abundance and value are the yellow and cherry birches, which attain a large size. Hemlock is frequent, as well as basswood and water elm. Ironwood is common and of large size. Rock elm is seen occasionally. White spruce and balsam are frequent. The commonest shrubs are mountain maple, the beaked hazelnut, red-berried elder, and moosewood. Red raspberries are very common. No black raspberries were seen, and few blackberries.

The soil conditions and forest growth in the part of Iron county examined show that good crops may be raised here in favorable seasons.

DICKINSON COUNTY.

The soil conditions which prevail in Marquette county are continued into southeastern Dickinson county except that the drift and gravels are mixed with a larger percentage of limestones and the forests are taller. The two tracts of land are so nearly alike in all material respects that it will be unnecessary to describe the county further, except to say that since the passing away of lumbering many good farms have been cleared and the crops on the ground indicate that business principles applied to agricultural operations will bring success here as well as in the lower peninsula.

C. F. WHEELER.

[Mr. Wheeler was unable to visit Menominee county.]

MR. BALL'S REPORT.

Superintendent of Farmers' Institutes:

Dear Sir—Agreeable to your request that during the Institute work in the upper peninsula I should learn as far as possible the agricultural conditions affecting farm operations in counties where Institutes were held, the following is submitted: A day was spent in driving over portions of each county where an Institute was held; and while no great amount of territory could be traveled over in so short a time, a general idea of the country was obtained, and with the specimens of the different productions shown at the different Institutes one could form a fairly intelligent opinion of what each county is capable of producing.

It is well known that the upper peninsula as a whole is very rich in its mines of iron and copper, with prospects of silver and gold in quantities sufficient to warrant investments in mining them. Large quanties of valuable pine lands have furnished untold quantites of lumber, and much remains unused, while large tracts of hardwood timber remain, which when relieved of the lumber and wood values will constitute the farming lands in a great measure of that portion of the State.

MARQUETTE COUNTY.

Marquette county (the first to be reported), has over two hundred farms, containing about 8,000 acres of improved land and twice that number of unimproved land. The township of Chocolay, south and east of the city of Marquette, contains the larger number of improved farms and is considered among the best for farming purposes. The land for farming purposes is somewhat scattered, or in other words is not in continuous large quantities. On hardwood ridges the land is as a rule fertile. The soil is not deep but in its new state is quite productive. Potatoes and grass are the main productions. Dairying to a limited extent is being carried on and in my judgment should be made one of the chief adjuncts in agricultural progression in that locality. The potato acreage in 1894 in the county was about 600 acres with a yield of about 7,000 bushels; and the acreage is still increasing. One farmer two miles from Marquette City has this year ('96) 70 acres of this crop which appeared very promising.

From three to five thousand acres of hay are cut yearly, yielding from 3,000 to 5,000 tons. Fine specimens of apples and plums were shown, while small fruits are grown in abundance. Nearly all kinds of vegetables are now grown and specimens exhibited were a credit to any locality. In this county large tracts of the best agricultural lands are owned by railroad companies, and are held too high in price considering the low price of farm products and the amount of hard work necessary before such lands can be put in good farm shape. Unlike the lower peninsula the wood upon such lands is not very valuable at present and in clearing has to be wasted in a large degree. Although as far north as latitude 47 and 48°, when the county is more generally cleared up and the low places drained, late frosts in the spring and early frosts in the fall will probably be less frequent and the county become better adapted to the growth of a greater variety of agricultural products. To a stury and determined class of young farmers without much means and who are willing to undergo privations and some hardships incident to a new country, this part of the State offers a variety of inducements.

IRON COUNTY.

Iron county, the next in order, has between one and two hundred farms, containing about 4,000 acres of improved, and 17,000 acres of unimproved farm lands. The township of Iron River contains the largest number of farms, Stambaugh, adjoining, being next in number. Mastadon following next in order. This county, like some other counties, has suffered on account of what is known as the homesteaders' trouble, on account of insecure titles to these lands. The matter is being adjusted, and it is hoped that in the near future these troubles will have disappeared and a marked hindrance to the improvement of the county annihiliated. This county, as its name indicates, is full of valuable iron lands or mines. Vast amounts of wealth lie buried in its hills and only await the good time which everyone is hoping for to bring forth from its hidden sources large quantities of this wealth. The best farm lands are those situated on the large tracts of elevated hard wood lands. They are rich in fertility, with limestone in profusion, which if lime was required as an article of merchandise would be a very valuable acqusition. The township of Iron River is largely peopled with Swedes, who are an industrious, hard working people and who will in the course of a few years have their farms in fine shape and also profitable as money-makers. The principal crops are potatoes, hay, and oats, though wheat is being grown to a limited extent. In 1894, one hundred and ninety acres of potatoes were planted and about 20,000 bushels of potatoes harvested, and the quantity planted and the amount harvested in 1895 and 1896 far exceeded the above quantities, both in acreage and yield. Over 2,000 tons of hay were cut in 1894, and over 4,000 bushels of oats harvested, and in 1895 very much larger quantities of both crops were secured. In 1895 oats yielded frequently 60 bushels per acre. In 1896 the straw was heavy but the yield and quality not so good. Wheat is being grown in limited quantities, but this locality bids fair to become quite a wheat growing region, especially of spring varieties. Fruits and vegetables grow well, apples predominating in the fruit line. The same remarks as to people and farming made with reference to Marquette county will apply to Iron county, and I think the prospects for the farmer better on account of a superior soil and fully as mild a climate.

DICKINSON COUNTY

is a new county, full of iron ore and with plenty of mines, some at work and some idle. The general character of the surface is somewhat similar to Iron county, but good farming lands not so plenty, with more of the poorer sorts. The township of Norway contains most of the lands used for farming purposes. Dickinson county in 1895 reported 55 farms, containing 2,251 acres of improved lands and 3,805 of unimproved land, of which amount the township of Norway claimed 1,287 acres of improved and 1,623 unimproved acres. Number of farms twenty. This number is increasing slowly. As a whole the land is not so fertile as in Iron county. There is less hardwood land and more of lightish sandy land. Though some wheat, corn, oats, and hay are grown in this county, the main crop is the potato crop, 31,000 bushels having been raised in 1894 with an increased amount in 1895. On some of the lighter lands of this county is located a farm of several hundred acres and finer crops of mangels, fodder corn, and hay need not be expected from the more fertile farms located elsewhere. These crops were produced by a systematic method in farming. Plenty of stock is kept and large quanties of manure made and properly applied, all going to prove that superior cultivation, even upon poorer land, brings with it a proper reward.

One thing noticeable in all the counties mentioned is a lack of sheep. As soon as suitable houses for winter shelter can be secured I believe that there is nothing that will tend to make farming in these localities pay so well as a proper number of good sheep. Add to this the dairy, which in both Iron and Dickinson counties should be increased. I saw some as good corn grown in the vicinity of Norway (fully matured) as need be seen in any county. Variety, what is known as flint corn. Wheat is grown quite successfully upon a few farms and probably may be on many more. Fruit and vegetables grow well. Among the many iron localities are found many acres of fair farming lands which should be cultivated and if the mines resume active work, as people believe they will, a home market and a good one will be found at the farmers' door. Land is cheap. The climate healthy, water pure, schools and churches abound, and while there are some drawbacks, there is much to encourage thrift and industry as applied to farming in Dickinson county.

MENOMINEE COUNTY

is situated further south than any of the counties enumerated and is from its location better adapted to agricultural purposes. This county has been noted for its lumber interests in the past, but as its forests of pine disappear farming operations increase and upon the whole men who have been engaged in lumbering are becoming convinced that the permanent wealth of the county lies in its agricultural capabilities. The surface of the portion over which I traveled, a distance of forty miles from north to south, was mostly level and soil for farm purposes mostly good. This was attested by the crops grown. The land reported as now in farms in 1895 was in round numbers about 53,000 acres. Of this number of acres about 20,000 are improved; number of farms about 600, and this number is increasing, judging from the new clearings and new buildings as seen along the highway. The township of Stephenson leads all the townships in the number of farms, amounting to nearly one-fourth of the whole. In this county are grown wheat, corn, oats, potatoes and hay; potatoes leading with an amount in 1894 of 88,634 bushels from 881 acres.

In the year 1894 there were raised 30,000 bushels of wheat from 2,191 acres, average yield 13.56 bushels per acre. Some corn was raised amounting to 1,121 bushels and 97,144 bushels of oats. Hay in 1894 amounted to over 8,000 tons. Fruit is generally grown, especially apples. Dairying in some parts of the county is carried on to a large extent, particularly at or near Menominee city. There are large amounts of farming lands for sale at reasonable prices in this county, lands which will become more valuable as farming takes the place of lumbering. The township of Stephenson takes the lead today in agricultural pursuits. The farmers are a wide-awake and intelligent set of men and women. At the last Institute held there a very fine display of horses for farm work was made. Some very good cattle and swine, but strange as it may appear very few sheep. The fruit and vegetable display was very fine and full. The work of the different schools showed thoroughness

and interest on the part of the teachers and pupils and spoke well for the general interest in all that goes to make a community prosperous and intelligent. The farmers in this part of the State think they are entitled to an experiment station and I think their ideas are sound. Many of the experiments made at the stations further south do not apply with particular force to those localities further north, and they think that the State Board of Agriculture should locate a station in that vicinity even at the expense of abandoning one in the south part of the State. I hope their prayer when presented will be granted.

As seen by the hurried visit in the counties mentioned, as well as by the study of the reports made from these localities, I am convinced that a prosperous future is in store for those farmers who will make the most of the opportunities at their command. No country in the world has the double or quadruple advantages in its ores as the Upper Peninsula of Michigan. Iron and copper, gold and silver will be stable commodities as long as people live. The mines so long idle will in the course of a short time be in full operation. Miners will have to be fed. A home market, the best in the world, awaits the farmer here. One of the essential needs in these localities is more stock of the proper sorts if they receive the care and attention that that stock requires in any locality.

Yours truly,

WILLIAM BALL.

FARMERS' INSTITUTES HELD IN 1896-7,

WITH DATES AND ATTENDANCE.

The attendance is figured in the following manner: The Secretary of the Institute and the Conductor sent by the Board each reported the attendance by sessions. The estimate is based on the largest number present at any one time of the session. We have averaged the reports of the Secretary and the Conductor separately, and averaged the results. Occasional discrepancies indicate some careless counting. But by the method used we have probably attained a generally fair estimate of the average attendance at each Institute. The attendance includes that at women's sections.

County.	Place.	Dates.	Average attendance per session.
Alcona	Harrisville	Jan. 5-6, 1897	58
Allegan	Allegan	Jan. 11-12, 1897	163
Alpena	Alpena	Jan. 6-7, 1897	74
Antrim	Mancelona	Dec. 1-2, 1896	96
Arenac	Standish	Feb. 4-5, 1897	220
Barry	Hastings	Dec. 15-17, 1896	43
Bay	Auburn	Feb. 3-4, 1897	134
Benzie	Benzonia	Dec. 8-9, 1896	147
Berrien	Niles	Feb. 26-27, 1897	349
Branch	Coldwater	Dec. 18-19, 1896	475
Calhoun	Albion	Feb. 19-20, 1897	309
Cass	Cassopolis	Feb. 25-26, 1897	308
Charlevoix	East Jordan	Dec. 3-4, 1896	127
Cheboygan	Cheboygan	Dec. 16-17, 1896	
Chippewa	Sault Ste. Marie	Dec. 17-18, 1896	67
Clinton	St. Johns	Jan. 21-22, 1897	101
Crawford	Grayling	Dec. 7-8, 1896	53
Dickinson	Norway	Sept. 30-Oct. 1, 1896	43
Eaton	Charlotte	Jan. 20-21, 1897	265
Emmet	Harbor Springs	Dec. 2-3, 1896	116
Genesee	Flushing	Feb. 16-17, 1897	396
Gladwin	Gladwin	Dec. 2-3, 1896	71
Grand Traverse	Traverse City	Dec. 4-5, 1896	104
Gratiot	St. Louis, Round-up	Mar. 2-5, 1897	596
Hillsdale	Hillsdale	Jan. 27-28, 1897	128
Huron	Bad Axe	Feb. 11-12, 1897	340
Ingham	Stockbridge	Jan. 18-19, 1897	215
Ionia	Ionia	Jan. 25-27, 1897	328
Iosco	Tawas City	Jan. 7-8, 1897	77
Iron	Iron River	Sept. 28-29, 1896	85
Isabella	Mt. Pleasant	Jan. 20-21, 1897	347
Jackson	Brooklyn	Feb. 17-18, 1897	230
Kalkaska	Kalkaska	Nov. 30-Dec. 1, 1896	116
Kent	Grand Rapids	Feb. 23-24, 1897	295
Lake	Chase	Dec. 16-17, 1896	134
Lapeer	Lapeer	Feb. 2-3, 1897	285
Lenawee	Adrian	Jan. 27-29, 1897	291
Livingston	Howell	Jan. 15-16, 1897	309
Macomb	Armada	Jan. 12-13, 1897	227
Manistee	Copemish	Dec. 7-8, 1896	209
Marquette	Marquette	Sept. 23-24, 1896	171
Mason	Scottville	Dec. 15-16, 1896	109
Mecosta	Morley	Jan. 18-19, 1897	151
Menominee	Stephenson	Oct. 1-2, 1896	205
Midland	Midland	Dec. 1-2, 1896	92

FARMERS' INSTITUTES HELD IN 1896-7.—Concluded.

County.	Place.	Dates.	Average attendance per session.
Missaukee	Lake City	Dec. 11-12, 1896	
Monroe	Monroe	Jan. 28-30, 1897	91
Montcalm	Carson City	Jan. 19-20, 1897	239
Muskegon	Muskegon	Jan. 14-15, 1897	156
Newaygo	Fremont	Jan. 15-16, 1897	226
Oakland	Milford	Jan. 13-14, 1897	438
Oceana	Shelby	Dec. 15-18, 1896	211
Ogemaw	Rose City	Dec. 3-4, 1896	110
Ontonagon	No Institute on account of	the great fire	
Osceola	Hersey	Dec. 17-18, 1896	104
Oscoda	Mio	Dec. 9-10, 1896	44
Otsego	Gaylord	Dec. 15-16, 1896	99
Ottawa	Holland	Jan. 12-13, 1897	116
Roscommon	Roscommon	Dec. 4-5, 1896	55
Saginaw	Chesaning	Jan. 22-23, 1897	155
Sanilac	Croswell	Feb. 9-11, 1897	317
Shiawassee	Laingsburg	Jan. 21-22, 1897	237
St. Clair	Emmet	Feb. 9-10, 1897	365
St. Joseph	Three Rivers	Feb. 24-25, 1897	434
Tuscola	Vassar	Feb. 1-2, 1897	322
Washtenaw	Chelsea	Jan. 19-20, 1897	242
Wayne	Plymouth	Jan. 14-15, 1897	370
Wexford	Sherman	Dec. 9-10, 1896	100

NOTE—Average per session for all Institutes held, except one-day meetings, 201.

LECTURERS AT FARMERS' INSTITUTES, 1896-7,

WITH TOPICS OF LECTURES.

We present below the names and addresses of persons who were sent by the Board as lecturers to the various Institutes. We also give their topics. We have divided the list of speakers into three classes:

I.

The following are regular employés of the State Board of Agriculture, and received expenses only while attending Institutes:

PROF. W. B. BARROWS, Professor of Entomology and Zoölogy, Agricultural College:
 1—Insects of the garden and orchard.
 2—Parasites of domestic animals.

DR. W. J. BEAL, Professor of Botany and Forestry, Agricultural College:
 1—Clovers and grasses for Northern Michigan.
 2—Forest control.
 3—Some troublesome weeds and how to eradicate them.

HON. I. H. BUTTERFIELD, Secretary, Agricultural College:
 1—The outlook for stock feeding.
 2—The silo.
 3—The present status of the thoroughbred animal on Michigan farms.

A. A. CROZIER, Assistant in Agriculture, Experiment Station, Agricultural College:
 1—Green manuring.
 2—Clovers and grasses.
 3—The family fruit garden.

M. L. DEAN, Assistant in Horticulture, Agricultural College:
 1—The potato patch.
 2—Orchard fruits for Northern Michigan.
 3—The apple orchard.
 4—The home fruit garden.

DR. H. EDWARDS, Professor of English Literature and Modern Languages, Agricultural College:
 Markets.

M. W. FULTON, Assistant in Agriculture, Agricultural College:
 Farm fences.

H. P. GLADDEN, Assistant in Horticulture, Agricultural College:
 1—Potato experiments at Michigan Experiment Station.
 2—Spraying: For the average farmer who grows fruit.

DR. E. A. A. GRANGE, Professor of Veterinary Science, Agricultural College:
 The structure of the milk glands of the cow, and diseases peculiar to them.

THOMAS GUNSON, Florist, Agricultural College:
 1—A few thoughts on the care and value of flowers.
 2—Flowers—their influence on rural life.

PROF. W. O. HEDRICK, Assistant Professor of History and Political Economy, Agricultural College:
 Progress in tax réform.

DR. R. C. KEDZIE, Professor of Chemistry, Agricultural College:
1—Wheats for Michigan.
2—Forecasts of frosts.
3—The simpler chemistry of the soil.
4—Soil exhaustion.
5—Feeding the soil.

PROF. F. S. KEDZIE, Adjunct Professor of Chemistry, Agricultural College:
1—Keeping up soil fertiltity,—what it means and how it is done.
2—Some interesting points about soils.

C. E. MARSHALL, Bacteriologist, Experiment Station, Agricultural College:
Bacteria and their importance in our everyday life.

PROF. EDITH MCDERMOTT, Professor of Domestic Economy, Agricultural College:
Demonstration lectures in cooking.

PROF. H. W. MUMFORD, Assistant Professor of Agriculture, Agricultural College:
1—Ten points in taking care of farm stock.
2—Why and how should the farmer be educated?

PROF. C. D. SMITH, Professor of Agriculture and Director of Experiment Station, Agricultural College:
1—The home dairy vs. the factory.
2—Stall fixtures.
3—Forage crops and how to raise them.
4—The home dairy.
5—The art of buttermaking.
6—Principles of stock feeding.

DR. J. L. SNYDER, President Agricultural College:
Practical education.

PROF. L. R. TAFT, Professor of Horticulture, Agricultural College:
1—Diseases of small fruits.
2—Diseases of pome fruits.
3—Diseases of stone fruits.
4—Treatment of plant diseases.

G. H. TRUE, Instructor in Dairying, Agricultural College:
1—Making butter in a dairy of less than five cows.
2—Better butter cows and how to get them.
3—Feeding the dairy herd in dry years.

PROF. H. K. VEDDER, Professor of Mathematics and Civil Engineering, Agricultural College:
Bridges and culverts for country highways.

PROF. C. F. WHEELER, Assistant Professor of Botany, Agricultural College:
1—Some bad weeds and how to eradicate them.
2—Smuts and rusts of grains.
3—Grasshoppers.

PROF. P. B. WOODWORTH, Assistant Professor of Physics, Agricultural College:
1—Water in physics.
2—Water in the air.
3—Water in the soil.
4—Water in plants.

II.

The following were employed especially for Institute work, and were paid a per diem and expenses while on such work:

HON. WM. BALL, Hamburg:
1—Value of improved stock and how to improve it.
2—How I grow wheat.
3—Maintaining soil fertility.
4—Does improved stock pay the average farmer today?
5—Business sense in farming.
6—How I grow corn.

J. H. BROWN, Climax:
1—Value of corn fodder for stock.
2—Cleanliness and care in the dairy.
3—Keeping up fertility.
4—The educated farmer.
5—The home dairy.
6—The silo.
7—The feeding and care of a dairy herd.

C. B. CHARLES, Bangor:
Improving and utilizing low lands.

I. N. COWDREY, Ithaca:
1—Potato growing.
2—The home dairy.

E. A. CROMAN, Grass Lake:
1—Buttermaking in a small dairy.
2—Shall we farm without keeping live stock?
3—Clover and other forage crops.

A. P. GRAY, Archie:
1—The farmer's fruit garden.
2—The essentials of profitable apple growing in Michigan.
3—Cultivation and care of small fruits for market.

R. M. KELLOGG, Three Rivers:
1—Pruning—its objects and its limitations.
2—Small fruits for profit.

MRS. MATTIE A. KENNEDY, Slocums:
1—What we farmers' wives need.
2—Being a helpmeet.
3—The life we live.

MRS. MARY A. MAYO, Battle Creek:
1—Making housework easier.
2—Mother and daughter.
3—Poultry raising for the farmer's wife.
4—The unappreciated side of farm life.
5—Home life on the farm.

ROLAND MORRILL, Benton Harbor:
1—Apples and plums.
2—Small fruits for market.
3—Business methods in farming.
4—Peaches and plums.
5—The home fruit garden.
6—Benefits of intensive cultivation.
7—The apple orchard.
8—Objects and methods of pruning.
9—Value of commercial fertilizers in fruit growing.

A. E. PALMER, Kalkaska:
1—Silos and silage.
2—Essentials for successful farming in Northern Michigan.

MRS. ELLA E. ROCKWOOD,* Flint:
1—Fathers and sons: From a mother's standpoint.
2—Some helpful hints for women who make butter.
3—The ideal home.

JOHN L. SHAWVER, Bellefontaine, Ohio:
1—Farm buildings.
2—Clovers, manures, and fertilizers.
3—Seed time and harvest.
4—The home dairy.

J. N. STEARNS, Kalamazoo:
1—The essentials of profitable apple growing in Michigan.
2—Cultivation and care of small fruits for market.
3—The farmer's fruit garden.

*Mrs. Rockwood met with an injury just previous to starting and was unable to attend any institute.

HON. R. L. TAYLOR, Lapeer:
  Bees and horticulture.
H. E. VAN NORMAN, Agricultural College:
  The farm dairy.
A. M. WELCH, Ionia:
  1—My experience with building and using silos.
  2—Successful milk production.
  3—Shall we buy or raise our cows?
  4—Economical sheep feeding.
  5—Winter feeding of cows, with and without silage.

III.

The following members of the State Board of Health spoke at various Institutes, for expenses only:

DR. H. B. BAKER, Secretary, Lansing.
PROF. DELOS FALL, Albion.
DR. MASON W. GRAY, Pontiac.
HON. A. V. MCALVAY, Manistee:
  Prevention and restriction of communicable diseases.
HON. FRANK WELLS, Lansing:
  Home sanitation.

OFFICERS FARMERS' INSTITUTE SOCIETIES

WITH NUMBER OF MEMBERS REPORTED FOR INSTITUTE YEAR, 1896-7.

County.	Membership.	President.	Address.	Secretary.	Address.
Alcona	23	J. Van Buskirk	Harrisville	Geo. Colwell	Harrisville.
Alger [1]					
Allegan	78	F. W. Robinson	Fennville	E. J. French	Otsego.
Alpena	27	E. O. Avery	Alpena	E. H. Toland	Ossineke.
Antrim	80	C. E. Mills	Mancelona	D. W. Marsh	Mancelona.
Arenac [3]		Peter Gilbert	Sterling	A. H. Welles	Standish.
Baraga [1]					
Barry	112	John Dawson	Hastings	R. M. Bates	Hastings.
Bay	70	T. F. Marston	Bay City	E. R Phillips	Bay City.
Benzie	74	Wm. G. Voorheis	So. Frankfort	R. B. Reynolds	Frankfort.
Berrien	52	C. H. Farnum	Benton Harbor	C. B. Groat	Niles.
Branch	175	L. M. Marsh	Gilead	A. J. Aldrich	Coldwater.
Calhoun	110	Jacob Wartman	Albion	Wm. A. Powell	Marshall.
Cass	98	T. T. Higgins	Dailey	W. W. Reynolds	Cassopolis.
Charlevoix	57	M. M. Burnham	East Jordan	E. B. Ward	Charlevoix.
Cheboygan	79	Jas. Fenton	Manning	C. F. Smith	Cheboygan.
Chippewa	63	H. A. Osborn	Sault Ste. Marie	T. R. Easterday	Sault Ste. Marie
Clare [1]					
Clinton	43	Decatur Bross	St. Johns	Geo. N. Ferrey	St. Johns.
Crawford	51	Oscar Palmer	Grayling	Henry Funck	Pere Cheney.
Delta [1]					
Dickinson	25	C. T. McElroy	Norway	L. F. Springer	Norway.
Eaton [2]		Jas. H. Gallery	Eaton Rapids	Geo. A. Perry	Charlotte.
Emmet	65	John Swift	Harbor Springs	Byron Bartlett	Harbor Springs
Genesee	86	Geo. W. Stuart	Grand Blanc	Jas. A. Button	Flint.
Gladwin	39	H. R. Clarke	Gladwin	Edgar B. Lamphear	Gladwin.
Gogebic [1]					
G'd Traverse		Samuel H. Sayler	Yuba	E. O. Ladd	Traverse City.
Gratiot	76	I. N. Cowdrey	Ithaca	C. A. Van Deventer	Ithaca.
Hillsdale	90	A. B. Cummins	Camden	Earl H. Dresser	Jonesville.
Houghton [1]					
Huron	211	John Hunt	Verona Mills	Mrs. Geo. Pangman	Verona Mills.
Ingham	72	Wm. H. Howlett	Dansville	L. H. Ives	Mason.
Ionia	227	Luther E. Hall	Ionia	C. I. Goodwin	Ionia.
Iosco	11	John Preston	Tawas City	Geo. Anschuety	Tawas City.
Iron	36	Wm. Greig	Iron River	P. O'Brien	Iron River.
Isabella	72	Wallace W. Preston	Mt. Pleasant	Michael E. Kane	Mt. Pleasant.
Jackson	80	E. A. Croman	Grass Lake	H. A. Ladd	Brooklyn.
Kalamazoo [1]					
Kalkaska	80	A. E. Palmer	Kalkaska	D. P. Rosenberg	Kalkaska.
Kent	359	Wm. T. Adams	Grand Rapids	W. K. Munson	Grand Rapids.
Keweenaw [1]					
Lake	32	Spencer Freedenbergh	Chase	J. G. Rogers	Chase.
Lapeer	75	Wm. W. Stickney	Lapeer	G. W. Carpenter	Lapeer.
Leelanau [1]					
Lenawee [2]		Geo. B. Horton	Fruit Ridge	H. H. Ferguson	Adrian.
Livingston	54	J. B. Tazziman	Oak Grove	F. D. Filkins	Oak Grove.
Luce [1]					
Mackinac [1]					
Macomb	47	John McKay	Romeo	Geo. A. True	Armada.
Manistee	60	Jacob Sears	Harlan	J. Herbert Read	Harlan.
Marquette	25	Robt. Blemhuber	Marquette	Louis J. Lavoy	Harvey.
Mason	32	Jerome Harman	Ludington	W. J. Meisenheimer	Ludington.
Mecosta	69	Geo. W. Fuller	Morley	Mrs. C. H. Ludington	Morley.
Menominee	21	Edward Sawbridge	Stephenson	Norwood Bowers	Stephenson.

OFFICERS FARMERS' INSTITUTE SOCIETIES, 1896-7.—Concluded.

County.	Membership.	President.	Address.	Secretary.	Address.
Midland	51	James G. Culver	Midland	Frank H. Olmsted	Midland.
Missaukee	45	Harvey Bartholomew	Pioneer	Jas. E. Wright	Lake City.
Monroe	64	E. L. Lockwood	Petersburg	J. W. Morris	Monroe.
Montcalm	54	N. L. Otis	Palo	Geo. H. Lester	Carson City.
Montmorency [1]					
Muskegon	67	Geo. Bolt	Bailey	Chas. E. Whitney	Muskegon.
Newaygo	53	E. C. Tinney	Fremont	W. C. Stuart	Fremont.
Oakland	93	Peter Voorheis, Jr.	Pontiac	F. N. Clark	Milford.
Oceana	65	F. J. Russell	Hart	W. N. Sayles	Hart.
Ogemaw	50	C. J. Phelps	Damon	H. S. Karcher	Rose City.
Ontonagon	40	Jas. A. Crooker	Ontonagon	H. M. Powers	Ontonagon.
Osceola	66	O. L. Millard	Hersey	Will L. Richards	Hersey.
Oscoda	22	John Randall	Mio	Robert Kittle	Biggs.
Otsego	45	Jos. Glasson, Sr.	Gaylord	J. Berdine Scott	Gaylord.
Ottawa [3]	42	A. G. Van Hees	Zeeland	Chas. S. Dutton	Holland.
Presque Isle [1]					
Roscommon	*	James H. Sly	Roscommon	Wm. F. Johnston	Roscommon.
Saginaw	44	Henry M. Youmans	Bridgeport	Jas. A. Slocum	Saginaw, W. S.
Sanilac	100	Richard Pearson	Urban	E. M. Denton	Sanilac Center.
Schoolcraft [1]					
Shiawassee	128	Elmer Warren	Ovid	Chas. B. Cook	Owosso.
St. Clair	27	Chas. S. King	Port Huron	Moses F. Carlton	Port Huron.
St. Joseph	129	C. A. Tyler	Nottawa	D. J. Porter	Three Rivers.
Tuscola	30	Chas. Selden	Vassar	Fred H. Orr	Caro.
Van Buren [1]					
Washtenaw	119	Wm. E. Stocking	Ann Arbor	H. Stumpenhusen	Rawsonville.
Wayne	174	J. H. Vreeland	Wyandotte	J. H. Hanford	Plymouth.
Wexford	65	Barton Colvin	Wexford	Elwood Peck	Cadillac.

1 Counties not organized under law of 1895.
2 County agricultural societies acting as Institute societies under the rules of the State Board of Agriculture.
3 Organized October, 1896.
* Not reported.

FINANCIAL STATEMENT.

FARMERS' INSTITUTE FUND, FOR FISCAL YEAR ENDING JUNE 30, 1897.

Amount of appropriation, $5,000.

Salary of Superintendent	$600 00
Traveling expenses of Superintendent	90 73
Salary of clerk	152 50
Per diem of lecturers	1,372 00
Traveling expenses of lecturers	1,961 48
Printing	31 75
Stationery	29 50
Office postage	166 30
Mailing copies Institute bulletin	100 00
Office apparatus	33 95
Apparatus for lecturers	*127 56
Farm Home Reading Circle	117 70
Sundry	†216 53
Total	$5,000 00

Further details regarding the work, the report of the papers and discussions at the State Round-up at St. Louis, as well as abstracts of many other addresses, will be found in the Institute Bulletin No. 3, issued in May, 1897.

REPORT OF FARM HOME READING CIRCLE.

SEASON OF 1896-7.

President J. L. Snyder, Michigan Agricultural College:

Dear Sir—I herewith transmit a report of the work of the Farm Home Reading Circle, carried on under the direction of the State Board of Agriculture, for the year ending June 30, 1897. This report is made as brief as possible, and includes the principal features of our work.

While the Farm Home Reading Circle is but little over four and one-half years old, yet we believe we can already boast of a longer period of uninterrupted progress than any similar movement in the United States.

Having started out with the determination to impress our rural population with the importance and value of pursuing a systematic course of reading, suggesting the best books along the various branches of farming and gardening, and furnishing these books to members of the Farm Home Reading Circle at much below the regular retail price, the management of the Farm Home Reading Circle has held rigidly to this policy.

*Includes fine stereopticon and outfit.
†Includes packing, boxes, cartage, and freight on Institute bulletins sent to County Secretaries for two years, 1896 and 1897.

During the year closing June 30, 1897, we have purchased and placed in our office a copy of each book recommended in the Farm Home Reading Circle courses. This was done for the benefit of a large number of visitors, who come to the College, that they might be able to examine the books.

We are confident that we have interested a large number of men by having such library.

During the late autumn we sent a press bulletin to a large number of the local county papers throughout the State, as well as to the various agricultural journals in this and other states. Quite a large number made mention of the work of the Farm Home Reading Circle, if they did not see fit to publish the press bulletin entire.

Circulars and advertising matter concerning the Farm Home Reading Circle were freely distributed among the people in attendance upon the Farmers' Institutes held in various parts of the State.

In twelve months we have enrolled sixty-five new members.

This number in no way indicates the number of readers, for in some instances the books are ordered by a Grange, Farmers' Club or community where several readers get the benefit of the same books.

Forty-seven reports were sent in for examination, and in each case the secretary felt warranted in issuing a certificate for each report thus sent. Some of the reports showed clearly that a large amount of study and thought had been devoted to the books, while in others and, I am glad to say, in much fewer instances, a lack of thorough work was manifest.

Orders for books were received from seventy-eight members. These orders varied from one to ten books,—these books ranging in price from fifteen cents to one dollar and seventy-five cents.

Three hundred and ninety-two enquiries were received in regard to the plan and expenses of the Farm Home Reading Circle.

It might appear that a larger number than did should have become members, but some enquirers seemed to have gotten the idea that the Farm Home Reading Circle, traveling libraries and free Experiment Station bulletins were different ways of expressing the same thing.

Then again, some may have become discouraged of ever being able to finish the course before they began, thinking that with a limited amount of time it would be next to impossible to complete the course on account of its length. There can be little question but that the careful reading of some fifteen volumes looks formidable to a man or woman not accustomed to study.

We are considering different methods of doing away with this possible present objection to our plan.

One of the most serious problems which confronts us in our work is the selection of suitable books. It often happens that we must offer two books in the same class which treat of precisely the same topics, and sometimes in a similar manner in certain parts of the books.

We are greatly in need of a carefully edited series of books for this Farm Home Reading Circle work.

Undoubtedly the next year will be the best in the history of this movement, thus far.

Very respectfully,

HERBERT W. MUMFORD,

Sec'y Farm Home Reading Circle.

COMMENCEMENT ADDRESS.

COMMENCEMENT ADDRESS, AUGUST 14, 1896.

INDUSTRIAL EDUCATION THE NEED OF THE COMMONWEALTH.

BY WILLIAM KENT.

Shortly after my acceptance of the invitation of your President to make an address at this commencement, he sent me a copy of the catalogue of the College, and at the beginning of the descriptive matter I found this sentence: "The constitution of Michigan requires that the legislature shall * * * provide for the establishment of an agricultural school * * * for instruction in agriculture and the natural sciences connected therewith."—[Revised Constitution 1850, Art. XIII, § 11.]

These words fill me with profound respect and admiration for the makers of the revised constitution of this State. It seems remarkable that as early as the year 1850 they should have foreseen the need of the State for such a college, and that they should have been so strongly impressed with that need that they incorporated a provision for the college in the constitution. And although five years passed before the legislature obeyed the mandate of the constitution by passing the act for the establishment of the college, and two years more elapsed before the college was opened, the date, 1857, was still so early that it enables Michigan to claim that it has the oldest college of its kind in the country. That date was five years earlier than that of the Morrill land grant act, passed by the United States congress in 1862, which has been the foundation of the agricultural colleges and of the departments of agriculture and mechanical arts in the universities in most of the other states, and which has largely supplemented the endowment of this College.

Both the provision of the Michigan constitution of 1850 and the Morrill act of 1862 were far in advance of the average sentiment of the people. It often so happens in legislative enactments. The makers of the constitution of the United States, the grandest political instrument ever framed, builded so well that their far-seeing wisdom is a matter of astonishment to us today, but it was with the utmost difficulty that their work was adopted by the states, and only the pressure of necessity compelled its adoption. It was far in advance of the average wisdom of the people.

So it is usually with legislation connected with educational matters. The establishment of public schools was opposed by a large portion of the community. "If a man wishes to educate his children, let him pay for it; it is not right to tax the public for his benefit," said the objectors. Later, when high schools were established, the same arguments were used, slightly modified. "It is all right to teach a boy the three R's," said they, "but the public should not be taxed for teaching him the higher branches." This argument against the high schools is still occasionally heard, but it has never, so far as I know, prevailed to such an extent as to cause the abandonment of a single high school in any part of our country after it has been established. The Morrill land grant act of 1862, through which the general government presented to the several states millions of acres of the public lands to aid in the establishment of schools of agriculture and the mechanic arts, was so little appreciated in some of the states that the proceeds of the sale of the lands were frittered away or badly administered, so that the benefits derived from the act have been far less than they should have been. I am glad to know that this is not the case in the State of Michigan and that the grant of the government has been so well administered that the present annual revenue from it is $42,000, or more than four times as much as is contributed this year by the taxation of the people of the State, while the United States supplementary grant of 1890 contributes $22,000 additional. Thus $64,000 of the revenue of this College is due to the far-seeing and beneficent paternalism of the United States government and only $10,000 to the State of Michigan. This latter burden of taxation upon the people of the State is so heavy, as is stated in a recent number of the College Record, that a property owner whose property is assessed at $4,000 pays a little less than four cents a year to the College. This burden, however, is so heavy in the opinion of the editor of a Michigan country newspaper, that he would be willing to sacrifice the College to get rid of it. He says: "This institution should be merged into the State University, to the end that the $3,000,000 tax may be whittled down. Were the voters of Michigan permitted to take action upon the matter they would either vote for consolidation or the wiping out of the expensive Lansing concern altogether." I have no doubt that the editor represents the opinion of only a small portion of the least intelligent of the community, and that his statement is a slander on the voters of Michigan. The support of higher education has never gone backward in the United States, and it is inconceivable that the State of Michigan, which was wise enough 46 years ago to put in its constitution a provision for founding its Agricultural College, will ever be so foolish as to abandon it.

The College is here, and is here to stay, but although it is nearly 40 years old, has, as far as I can judge, an ample endowment, good location, splendid equipment, well qualified teachers, and an admirable system of instruction, free tuition and very low expense for board, everything, in fact, which such a college should have, it is still so far in advance of the times and of the popular sentiment, that it is not appreciated as it should be by the citizens of the State in general and by the farming community in particular. The proof that there is such a want of appreciation is this single statistical fact: the College has in its agricultural department 269 students, of whom 39 are from outside of Michigan,

while the last census shows that 208,442 men over 21 years of age are engaged in some form of agricultural work in the State. That is, there is only one student in college to every 900 men of full age engaged in agriculture. If each family has on the average five persons, only one family engaged in agricultural industry out of every 180 has a boy in the College. Making every allowance we please for the poverty of many farming families, and for the fact that many families do not contain boys of college age, still the figures show that the reason there are only 269 agricultural students here is that the farmers in general are not willing that their sons should come here.

That the farmers' sons do not come here is not the fault of this particular college, of its methods or its teachers. If that were the trouble we would find the farmers sending their sons to agricultural colleges in other states, which they are not doing. It is not due to the fact that it is not right to give a farmer's boy such an education as this College affords, for there is no such fact; the fact is just the reverse. It is not at all probable that the reason is that the farmers are parsimonious; I do not believe that they are. The sole reason, in my estimation, is that the farmers in general are not yet educated up to the belief that the course of instruction given by this College would be of benefit to their boys. Many of them are in fact decidedly prejudiced against such a course of instruction.

The farmers are not to be blamed for this lack of education or for their prejudice, for in the case of the vast majority of them there has been nothing in the whole course of their lives or of that of their ancestors to free them of such a prejudice. We might as well blame the men of the Middle Ages for their neglect to study the natural sciences, the men of the fifteenth century for their disbelief in the theories of Columbus, and the men of the eighteenth century, even after the electrical discoveries of Franklin, Volta and Galvani, for failing to invent the telegraph. There is nothing in the whole realm of human opinion in which the majority of men are so conservative as in matters of education. How many years it required from the time of Frœbel until the idea of the kindergarten was so generally accepted that it became adopted in even a few of our public schools? After the excellence of the manual training system of Russia was shown in our Centennial Exposition in 1876, how long it was before the manual training idea became at all popular in this country. It was not until after millions of dollars had been spent by some of our philanthropic rich men in establishing private manual training schools, many books had been written and lectures given upon the subject, that public boards of education began to consider the question and manual training was introduced into the public schools. It is not only among uneducated men that prejudices in educational matters exist to such an extent that they restrain progress, for manual training was opposed by some of our most eminent educators. The fetich of the study for years of Greek and Latin as necessary for all educated men still exists in the minds of many learned teachers, and their theories and prejudices in favor of the old classical education are still responsible for wasting the time of thousands of students and for preventing them from acquiring knowledge in other branches which would be of vastly greater benefit to them.

So the farmer is not to be blamed for his lack of knowledge of the benefits of an agricultural college course. We must have patience with him. He will grow to this knowledge, or if not his successors of the coming generation will, and the college will be crowded with students and will be asking the State for increased appropriations in order to provide buildings to hold them.

Let not the advocates of the Agricultural College be discouraged. Its day is coming, just as the day of the technical mechanical engineering college has already come. It is just 20 years ago that I graduated from a mechanical engineering college in the east. There were then probably not over 50 graduates of such colleges in the country, and they were a drug in the market. It was panic times then, but the workshops of the country did not then appreciate the graduates, and the few that obtained work in these shops had to go in at the very bottom as apprentices. Now the conditions are entirely different; there are some thousand such graduates in the country and there is a steady demand for them. They soon rise to hold the best positions in the shops, and the owners of the shops are sending their sons to these colleges to obtain the kind of education that will be of most use to them. Some of the graduates are now old enough to have sons of college age, and they are sending them to the same college. Such, I predict, will be the course of the agricultural colleges. The graduates of this College will soon be the superintendents and owners of the best farms in the country, and they will send their sons here in ever increasing numbers.

Meanwhile it is the duty of those interested in the College, as professors, instructors and graduates, not to cease from their work of educating the farmers of the State as to the usefulness of the College. Let them through their College paper, through the agricultural papers of the country and through Farmers' Institutes and fairs, cause the work of the College to become known, and in due time the farmers will come to believe in the College, not only as a place to which they should send their sons, but as a direct benefit to the whole State, as an institution which is so important to the welfare of the State as a whole that it will never fail to receive their support when its needs compel it to ask additional appropriations from the legislature.

Let us now consider a few thoughts which lead up to the belief that the Agricultural College is not in any sense a charitable institution existing for the benefit of its students, nor even a class institution provided for the benefit of the agricultural interests at the expense of the taxpayers at large, but rather as a State investment which will return to the State its cost a hundred times over, an institution designed to safeguard the State against the dangers of the industrial and commercial wars of the future, just as West Point is designed to safeguard the nation against foreign invasion.

In New York city there exists an apprentices' library founded by the Society of Mechanics and Tradesmen, which was instituted over a century ago. On the walls of the library hangs the ancient banner of the society, with its emblem and its motto. The emblem is an uplifted right arm with the hand grasping a hammer, and the motto is the quaint couplet, "By hammer and hand all arts do stand." Such was the honor given to the hammer and the hand as the foundation of industrial art over a hundred years ago. If we were asked to frame a motto at the

present day for the foundation of the industrial arts it would read about as follows: "By the steam engine and by the brain of man, guiding the hammer and the hand, all arts do stand." The change is made necessary by the industrial revolution that has characterized the present century. The hammer and the hand are now only minor tools. The steam engine is the great power which is doing the mechanical work of the world, and it is the brain of the captain of industry which determines what work the steam engine, the hammer and the hand are to do, and which today is the chief factor in increasing the wealth of the race. The revolution has now been in progress for over a hundred years, ever since the general introduction of the steam engine into factories. So long has it continued, and so steady and gradual has been its progress that but few are able to realize its extent.

One great consequence of the revolution is that agriculture has been relegated from the first to the second place in the industries of the United States, and manufacturing industry has taken the first place. Of all the material and marketable things which man in this country produces and consumes, manufactured goods form the chief part, measured in money value, and agricultural products the second. The application of machinery to farming, the migration of farmers from the sterile lands of the east to the fertile lands of the west, the improvement in character of the crops, and the increased application of fertilizers, have all tended to make a smaller fraction of the population necessary to produce the food for the whole country and to discharge men from the farm and turn them into other pursuits. One reason that great cities are growing at such a remarkable rate is that factories are built in the cities and the average working man can make more money in them than he can on the farm. He is discharged from the farm where the demand for his labor is relatively diminishing and he is welcomed in the city where the demand for labor is increasing. The agricultural industry of the country is now going throug a transition stage which is in many respects similar to that through which the iron manufacturing industry went in the 20 years preceding 1890. In that period the production of pig iron quadrupled, while the number of furnaces in blast decreased about one-half, and the cost of making pig iron also was diminished by half. The average product of a blast furnace was multiplied eight-fold in that period,—not that any given furnace in 1890 produced eight times as much as it did in 1870, but new furnaces were built which caused the abandonment of the old ones and in many cases the bankruptcy of their owners. New districts were developed in which iron could be made more cheaply than in the old, the furnaces in the old districts were allowed to fall into ruins, and millions of dollars' worth of invested capital were thus wiped out. The period of 20 years was one of readjustment and relocation of the industry, and it was one of severe competition in prices and of struggle for existence, in which the law of the "survival of the fittest" operated most disastrously to the unfit.

I have already spoken of some of the causes which tend to make a smaller number of farmers, relatively to the whole population, necessary to provide the food for the country. There is another cause tending in the same direction, and it is one not peculiar to this country, but is world-wide in its operation. Hitherto a considerable portion of the farmer's market has been furnished by the demand for export. This

demand is gradually diminishing. Southern Russia both in Europe and in Asia, Egypt, India and the Argentine Republic are becoming every year more vigorous competitors of the United States in the grain markets of Europe. With the building of railroads in these countries and the development of their farming industry, it is only reasonable to expect that the United States will grow less and less important as a contributor of heavy agricultural staples to Europe, and it is not at all improbable that within ten years our exports of wheat to Europe will have practically ceased.

There will, of course, be an increasing demand for the great food staples within the United States, coincident with its increase of population, but the development of the great grain belt of the northwest is still in progress, and the wheat, corn and oats will be grown in the districts best fitted for them, and the abandonment of their growing in the districts least fit will continue. The law of the survival of the fittest is operating in the farming industry as it is in manufacturing, and the farmer who would survive the struggle must learn how to adapt himself to the changing conditions of his environment.

The prospect now in view is one of hard times for the average farmer during the years in which the changes referred to are taking place, but one may with hopefulness look beyond the immediate present to a new era of prosperity in which the intelligent farmer will share probably in greater measure than any other portion of the community. If we can divest ourselves for a time of the despairing feeling engendered by the recent period of depression and make a calm survey of the development of the country as shown by statistics for long periods, we shall find much to give us encouragement for the future. In this connection a study of some of the figures given by the census of 1890 showing a comparison of the production of the manufacturing industry of the country in the years 1880 and 1890 is most instructive. I will not trouble you with the figures, those who wish can find them in the Census Bulletin, but I may mention a few general conclusions which the figures prove. Between the years 1880 and 1890 there was a vast increase in the production of every manufacturing industry, measured in dollars and cents as well as in weight and bulk, notwithstanding the fact that prices of commodities greatly decreased. The increase in production was far greater than the increase in population. It took place in finished lumber, in boots and shoes, in cotton, wool and silk fabrics, in made-up clothing, in books and newspapers, in iron, machinery and hardware of every variety, in pianos, carriages, railway cars and locomotives, and in manufactured articles of luxury of every description. The great bulk of consumption of perishable articles and the storing up for use or ornament of articles not perishable, such as fine furniture, pianos, books, pictures and the like, is by the common people. The purchasing power of a vast majority of the common people must have greatly increased or this increased amount of manufactured goods would not have been made. The statistics further prove that wages increased, as did also the savings of the common people, as shown by the records of life insurance societies, savings banks and building and loan associations. There is abundant evidence that the era of prosperity from 1880 to 1890 showered its benefits upon the poor and the rich alike, and that the ordinary workingman contributed to the general prosperity of the country by

purchasing a greater quantity of manufactured articles than he was ever before able to do in the history of the world. The figures of the census of 1890 compared with those of 1880 prove the falsity of the saying commonly heard from the lips of profesisonal agitators and of the ignorant that the rich are growing richer and the poor are growing poorer. The figures show, on the contrary, that in the ten years considered the whole people were growing richer and the poor were growing fewer.

I have seen no figures of the consumption of farm products other than the great staples, but I have no doubt that if the statistics could have been collected they would show that there was in the same period a great increase in the consumption of those articles grown by the farmer that are usually considered luxuries, such as spring chickens and lamb, green peas and asparagus, the finer fruits, early vegetables, melons, the finer cheeses, cream and ice cream. The increased use of flowers for decorative purposes is a matter of common knowledge, as is also the increase in the purchase of fine fruit trees and of shade trees by the suburban cottager. I have no doubt, also, that a comparison of these years, if it could be made, would show an improvement in the grades of horses and cattle.

The conclusions which I wish to draw from these facts are these: 1. The increase in consuming power of the people of the United States, growing faster than the increase in population, is the normal condition. If temporarily suspended for a few years, by financial depression, it will again take place in even greater degree. 2. The people will consume more of the finer productions of the farmer, those which may be classed as luxuries, while the consumption of the staple grains, wheat, corn, oats and rye, per capita, may remain about stationary. 3. The increased development of manufacturing, which is the chief cause of the increase of wealth of the community, will continue to make our cities and towns grow larger and provide a larger home market for the near-by farmer of those products which he can supply to better advantage that the more distant farmer, while the staple grains will be supplied from the lands best adapted to produce them, even if they are a thousand miles or more distant from the manufacturing cities.

The farming of the future in the great manufacturing states, of which Michigan is one, will be characterized by variety of crops and by finer grades of products, both vegetable and animal. In earlier times the articles of food consumed by the great bulk of the community were few in number and common in kind. Salt pork and corn bread, "hog and hominy," potatoes and gravy, rye bread and molasses, were the staple articles of diet, while white wheat bread, porterhouse steaks and grass butter were luxuries for special occasions. The farmer in those times had plenty of hard work, with his lack of modern machinery. His education in the science of farming was such as he obtained from his father while at work on the farm, and his farming methods were those of his grandfather. His farming education, such as it was, was sufficient for his needs, for if he learned how to raise corn and hogs on the old farm as well as his father did, what more was there to be learned? No need then for books on agriculture, for Farmers' Institutes, still less for an Agricultural College. What good could chemistry do on a farm in those days, and what farmer then ever heard of entomology or bacteriology?

Now everything has changed. The community as it increases in wealth demands a larger variety of food products and is willing to pay for the very best that can be grown. The farmer to meet this demand finds the education of his father and grandfather no longer sufficient. He must learn how to do more things and better things than ever they did. His education must be of a broader and more varied kind than their's was. The successful farmer of the future will not spend his life in manual drudgery, working with his hands from sun to sun, as his ancestors did, while his wife drudges from sunrise to midnight to do her share of the work and at the same time board the farm laborers. He will work less with his hands and more with his brains. Much of the old-time drudgery will be done away with by the use of machinery, and what remains will be done by common laborers, which, like the poor, we will always have with us, although, like the poor, they are becoming fewer as machinery pushes them up in the scale of humanity.

Above all, the farmer of the future must be an educated man. He must have a cultured brain and know how to use it in his business. There are two things which characterize a thoroughly intelligent and well educated man. First, natural brain capacity, which he inherits from his ancestry, and second, culture, which is obtained only by systematic training. The first is possessed in large measure by our farming population, as is seen by considering the fact that thousands of our most eminent lawyers, legislators, bankers and merchant princes began life as farmers' boys. How is the farmer's boy to get the second, namely, brain training or culture? The experience of the race for a thousand years shows that the best, if not the only practicable way is to send him to college. If we take the farmer's boy and want to make a minister, a doctor or a lawyer out of him we must send him to a college of theology or medicine or law. If we want to make him a superintendent of a machine shop, even, or a builder of locomotives or of electric lighting plants, we must send him to a mechanical college. The day is coming, if it is not already here, when if we want to make a successful farmer of him we must send him to college. Not to the old-fashioned college, where he will spend his best years in Latin, Greek and mental philosophy, which will be of no use to him, and in foot-ball and rowing, which may be useful as antidotes to the Greek and Latin, but to a college where he will study English literature and mathematics, two most essential elements of practical brain training, and the natural and physical sciences which have a direct application to agriculture. In the college, also, he will learn the scientific and only true way of making experiments and of drawing conclusions from his own experiments and from those of others. In the agricultural college he will not only obtain the broad foundations of an education, but he will be taught by actual practice in the field the best ways of doing things on the farm. In its library he will have access to books and periodicals which contain the latest information concerning the progress of the science and practice of agriculture throughout the world, by the use of which he will acquire habits of study and of scientific thinking which will cling to him through life, which will not only be a constant source of pleasure in the intervals of rest from toil, but will also be of material benefit in assisting him to solve the numerous perplexing problems which will arise in the ever-changing and ever-advancing progress of the farming industry.

Thus far we have chiefly considered the benefit of the agricultural college to the individual farmer who is fortunate enough to become one of its students, but its benefits are much farther-reaching and apply to the whole commonwealth.

It was truly said a long time ago that "he who makes two blades of grass grow where one grew before is a public benefactor." Not merely a benefactor to himself, but to the whole community, a public benefactor. Take a bright boy from one of the poorer farms of the State, furnish him a couple of hundred dollars to help pay his way through the college. The college gives him an education. He goes back to the farm and begins to improve it. Studying the course of the markets and the capabilities of the farm, he learns what to grow and what not to grow. He applies the kinds of fertilizers best adapted to his land, changes the breed of stock, builds a silo, plants the best varieties of fruit trees, raises some shrubbery and flowers for the Detroit market. In twenty years or so he has amassed a moderate fortune, builds a fine house, furnishes it with a library, musical instruments and pictures, and lives as a wealthy country gentleman should. He attributes the foundation of his success to the education he received at the college. But has he only been the gainer from his education. He has made two blades of grass grow where one grew before; he has been a public benefactor whether he desired to be one or not. Not a dollar of his wealth has been made except by the increased value of the products of the soil, and his becoming richer has made no man poorer. He has furnished the people of the city with the finer produce of his farm at good prices, which they were willing to pay. He has hired more workmen on his farm, and has been compelled through the general prosperity of the country to advance their wages. When he builds new barns or a new house, buys improved machinery, wears better clothes, drives in a better carriage, he has to give employment to more high-priced workmen. He pays more taxes, gives more work to the railroads. Every dollar of profit he makes he must do something with, and whether he spends it to improve his property or puts it in the savings bank where it will be loaned to do useful work for someone else, he improves the financial condition of the community. But more than this, every improvement he has made in his farm or in his farming methods has been made under the eyes of all his neighbors. He cannot keep a farming secret if he tried. They profit by his example, and as far as they are able improve their farms and their methods also. If the whole farming community becomes rich it furnishes a valuable market to the manufacturers, who thus share in the farmers' prosperity. Rich farmers, who have made their riches by cultivation of the soil, are good citizens, and the more such citizens the country has the better. In so far as the college can assist in making of a farmer's boy a broad-minded, intelligent, well educated citizen, in so far as it can teach him how to make two blades of grass grow where one grew before, it performs a work which is of vastly more importance to the commonwealth than it is to the individual student. The college is the great public benefactor in that it turns out men fitted to become public benefactors.

The foregoing remarks have had relation chiefly to the importance of the Agricultural College to the welfare of the State, but much of what has been said might be repeated in regard to the value of technical schools of other kinds than agricultural. This College has established

a mechanical department, wisely following the example of other states which have endowed schools of mechanical engineering. The results achieved by these schools during the last twenty years in turning out thousands of graduates who now hold prominent positions in our mechanical industries are well known, and their value to the nation is beyond calculation. The usefulness of these schools is now generally appreciated by the public. They are crowded with students, they have been liberally endowed by the states and by the general government, and millions of dollars have been contributed to them by private individuals. Already the alumni of some of them are showing their appreciation by raising funds to provide them with new buildings and equipment. There is no need to further discuss the question of the schools of mechanical engineering. Their position and their future are secure. The progress of agricultural schools has hitherto lagged behind that of the schools of engineering, but there can be no doubt that it will ere long receive a new impetus and that the agricultural schools will obtain that measure of public appreciation and that increase of endowment which their importance deserves.

The position of the engineering schools of the United States is now in advance of that of similar schools in any other part of the world, and probably the same may be said of our agricultural schools, but in other branches of technical education we are far behind Europe, and in fact have scarcely made a beginning. I wish to quote in this connection the words of ex-President Willits of this College, spoken in 1885. He said:

"Continental Europe, older in these industries, long since saw the necessity for special attention to the matter, and during the last fifty years has expended large sums on schools of technology and the promotion of science lying at the base of all the industries. The result has been marvelous. England, that once ruled the industrial as imperially as she did the commercial world, at last became anxious over the competition of nations that for half a century or more had been her lavish purchasers, and began to inquire how this ability to compete in her manufactures had been brought about, and was after a full investigation into the principal causes compelled to admit that it was to be attributed more than anything else to the schools of technology and mechanic arts which those countries had the foresight to establish." He further says: "Our industries are an important factor in our body politic, and our future is to be largely shaped by our ability to manufacture as well and as cheaply as anyone else. To do this we must put intelligence into our shops and theoretical instruction into our schools. We must occupy the ground ourselves with our own brains and muscle. Two-thirds of our foremen and master mechanics are foreigners, educated in the technical schools of Europe or instructed by an apprenticeship that is not germane to our institutions."

I doubt if the statement made by President Willits 11 years ago, that two-thirds of our foremen and master mechanics are foreigners, would hold true today, and it surely would not in the case of our iron-working establishments, but it is probably nearly true today in most of the skilled industries outside of iron working, and especially in those in which artists and designers are engaged. The great bulk of our artistic designing in iron, in silver and other metals, in textile fabrics and in wood, is done by foreigners. Michigan is famous for its furniture

industry, but I venture to say that its best furniture is designed by foreigners and is but a servile copy of the French and English furniture of the last century. Why should not Michigan furniture be as renowned for its genuine artistic merit as it is for its quantity and its cheapness? If we had a technical school of furniture design we might make Michigan furniture of the beginning of the twentieth century as intrinsically valuable as the French furniture of the eighteenth century. Our designers and artists are mostly foreigners, and the best designers and artists stay in Europe. If an artist is born here, whether a musician, a painter, a sculptor or a worker in wood or metal or in textiles, he must go to Europe to get his training. Such things ought not to be, and will not be when this country is properly provided with schools of art and design.

Another need of our times is for well skilled journeymen in the trades. Common mechanics, able to earn $2 to $2.50 per day, are plenty enough, but the highly skilled fine workman worth $4 and $5 a day is a scarce article. Our shops as at present organized with their lack of apprenticeship system, and our trades unions with their methods of leveling all members to one grade, are not calculated to make high-priced workmen. A man who gets $2 a day in a shop is worth to his employer but little more, for he can be easily replaced by as good a man at the same pay, but the man who gets $4 is usually worth to his employer and the the community which receives the finished product of his skill, far more than his wages, and if he dies or moves away his place is not easily filled. If we get highly skilled workmen from Europe they are not apt to be the best. The best ones have good positions in Europe and are content to stay there. The greater the number of highly skilled and high priced workmen the state has, the more prosperous is the state. How are we to get them? The shops do not make them, the trades unions do not, the apprenticeship system by which they were once made is dead, and Europe will send us only the second best. If we wish the best, there seems to be no way left in which to obtain them but the establishment of trade schools. A beginning in such schools has been made in New York and Philadelphia by private munificence, and no doubt they will be in time established all over the country, but a public opinion in their favor must first be created before they will multiply to any great extent.

The State of Michigan has done a noble work in founding her Agricultural College, she has done wisely in adding to it a mechanical department. Let us hope she will soon continue the good work by founding a school of industrial art and design and a system of trade schools for the training of highly skilled workmen. She has a grand geographical situation, surrounded by the great lakes, an ideal position for commerce, a fine climate, a fertile soil, is wonderfully rich in resources of the forest and the mine. What more does she need? A race of broad minded, well educated and highly skilled men. Such men it is the province of the schools to furnish. Let Michigan give a generous support to the technical and industrial schools she now has and provide liberally for those trade schools and art schools she will need in the days to come. She can make no better financial investment, and nothing else that she can do will contribute so much to her development as a prosperous and happy State.

MEMORIAL EXERCISES.

MEMORIAL EXERCISES.

TO THE MEMORY OF EDWIN WILLITS, PRESIDENT OF THE MICHIGAN AGRICULTURAL COLLEGE, 1885-1889.

HELD IN THE COLLEGE CHAPEL, THURSDAY AFTERNOON, NOVEMBER 19, 1896.

A clean, strong successful life is a precious legacy to posterity, and we cannot guard its proportions too jealously from the gnawing tooth of time, or seek too anxiously to transmit it unimpaired in fullness, beauty and truthfulness of form and lineament.

The Agricultural College has always taken an especial interest in the personality and pride in the career of the late Edwin Willits, and when the sudden announcement of his death came it was intuitively felt that we were only performing our official function toward the youth in our charge when we set apart a certain time for exercises in memory of him, and sought to put here in permanent form the loving tributes laid upon his bier.

The life work of Mr. Willits was wide and varied. He was a successful lawyer, an influential congressman, a resourceful and inspiring college president, and a statesmanlike cabinet officer. At his bier were gathered in common sorrow the student, the scientist, the man of affairs, the lawyer and the statesman. In our memorial exercises each of these classes found a fitting representative, and each presented the character as he saw it. It is a uniform testimony that they bear to the intense energy, the steady, cool, selfpossession, the ready sympathy, the contagious hopefulness, the sturdy courage and the resourcefulness of the man they all loved.

RESUME OF DATES IN DR. WILLITS' LIFE.

Dr. Willits was born in Otto, Cattaraugus county, New York, on April 24, 1830. He came to Michigan with his parents in 1837. He was graduated from the University of Michigan in 1855, and for ten years thereafter he was editor of the Monroe Commercial. In 1856 he began the study of law, was admitted to the bar in 1858. In 1860 he became prosecuting attorney of his county. For twelve years from 1862 he was

a member of the State Board of Education. From 1863 to 1866 he was postmaster of Monroe. He was a member of the constitutional commission of 1873, and from 1876 to 1880 was a member of congress. In 1883 he was made principal of the State Normal School at Ypsilanti, and he remained in that position until called in 1885 to the presidency of the Agricultural College of Michigan. In 1889 he was called from the College to the position of first assistant secretary of agriculture at Washington. In 1894 he was removed from this position by Secretary Morton, whereupon he opened a law office in Washington. He died there October 23, 1896.

EXERCISES IN THE COLLEGE CHAPEL.

Thursday afternoon College duties were suspended, and at the appointed hour the Board of Agriculture, faculty, students and visiting friends of the deceased assembled in the chapel to pay a last tribute to his memory.

President Snyder presided over the exercises, and, after an opening hymn and prayer by the Rev. Dr. Jordan, he introduced Hon. Franklin Wells, president of the Board of Agriculture, who made a very brief address on behalf of the Board. Governor Rich was unable to be present, and Prof. Babcock read his paper. This was followed by an address by Prof. Daniel Putnam of the State Normal Shool, who spoke of his eminent services for that institution.

It was expected that H. B. Cannon, '88, who was Mr. Willits' private secretary while the latter was assistant secretary of agriculture, would be present to speak of Mr. Willits from the students' standpoint, but a summons on the grand jury prevented, and his paper was read by Prof. Hedrick. President Snyder then read a letter from ex-Governor Luce, after which he introduced the last speaker for the afternoon, Dr. Kedzie, who has been for many years an intimate friend of Mr. Willits.

Among the visitors present were Dr. Boone, principal of the Normal School; F. E. Skeels, '78, of Grand Rapids; Charles B. Collingwood, '85, Lansing; and Jason E. Hammond, '86, Lansing.

Following are the addresses as given:

ADDRESS OF PRESIDENT WELLS.

We are assembled here today to pay our last tribute of affection and regard to the memory of a good man.

It was my good fortune to have known Edwin Willits for nearly a quarter of a century. I first became acquainted with him in the city of Lansing in 1873, at which time he was attending the constitutional commission of that year. During the session of congress of which he was a member, I met him occasionally, but our acquaintance became more intimate and close after he came to the College as its president, and it was kept up by personal interview and by correspondence until the day of his death.

When Dr. Abbot, on account of failing health, desired to be relieved of the responsibility and burden of the presidency of the College, the Board of Agriculture seemed instinctively to look to Mr. Willits as his

successor. The success of his administration of the affairs of the Normal School had been substantiated and known throughout the State, and his reputation as a successful, broadminded educator had been well established. Col. McCreery, then a member of the Board, and myself were appointed a committee of the Board to interview him, and by appointment we met him at his home in Ypsilanti. At that time I became very much impressed with his personality. He at once entered into the spirit of the business in hand. I was delighted with his frankness and candor. Almost his first remark was, "Gentlemen, can I make the Agricultural College a great and useful institution, a power for good in the State? If I can't, I don't want to consider your offer for one moment. I am well situated at present. I believe I am doing some good, and unless you can invite me to a broader field, where I can do more good, I must not think of a change."

We spent the evening with him talking over the prospects of the College, presenting our side in the best light we could, and left him with the promise on his part to consider the matter favorably, and after consulting with Mrs. Willits, and giving the matter thorough thought, would see us again by appointment.

After much thought and thorough investigation, he came to the College as its president. He at once won the confidence and respect of the Board of Agriculture, the faculty and students. While he was a man of great ambition and untiring energy, his zeal was tempered with justice and discretion. He felt that much good might be done to a class of young men in the cities and towns if they could become interested in the mechanical lines connected with the College course, and he at once set about reaching this class, hence his great interest in the development of that department, which owes its present importance as a department of the College as much, more perhaps, to him than to any other cause.

When called to the Department of Agriculture at Washington as assistant secretary, he left the College, but I am quite sure regretfully. On his receipt of the telegram asking him if he would accept the appointment, I received from him a telegram saying, "What shall I do?" He has never lost his interest, and in all our correspondence has expressed his love for the institution and manifested a great desire for its success.

Although he had passed the meridan of life, he was strong in body and mind, and to all appearances had a long and useful future before him, but he has gone, not lost, only gone on before to another and better country.

A TRIBUTE FROM GOVERNOR RICH.

It was my good fortune to know Hon. Edwin Willits well. Like many another man in this country he owed his success in life to his own exertions. While not born in Michigan, he was practically a Michigan product, as he came here when only six years of age. He came of good stock, from the Empire state, to which Michigan is indebted for many a man whom she has delighted to honor, as well as being honored by them. Mr. Willits did what he attempted well. In all the positions of trust and honor which he was called upon to fill he acquitted himself with honor; and in all these positions his work was done in such a manner as to make his administration more than ordinarily conspicuous.

Personally, I did not know of his services as prosecuting attorney, or member of the State Board of Education, but all reports show that his services were conscientiously performed, with more than ordinary ability, and to the satisfaction of his constituents. The same may be truthfully said of his work as member of the constitutional commission of 1873.

In congress his services were of a high character. He was intelligent, industrious and painstaking in all he did. Ever faithful and diligent in performing the numerous errands and detail matters for his constituents, yet unlike many others he never considered these the principal duties of a member of congress. He studied hard and endeavored by every means in his power to ascertain what legislation and what general policy was best for the country, and having made up his mind, urged the adoption of such measures vigorously and intelligently, not only on the floor of the house, but in committee rooms, through the press, to which he was an occasional contributor, and in private conversations. He had a high ideal of what a politician should be, and would never stoop to anything he deemed dishonorable. While he was a dyed-in-the-wool republican, and believed fully in its great cardinal principles, yet, in some of his convictions he showed some of the characteristics of the other belief. His studious life and his conscientious defense of the constitution and laws of his State and country made him a strict constructionist to some of his colleagues who, from their standpoint, believed it better to be more practical and less technical. While he was a protectionist, he was conservative, and never took extreme positions on this question. He was firm and steadfast in his views and had the courage of his convictions, but was always tolerant of the opinions of others.

As president of the Normal School and Agricultural College I only know by the universal approbation which all those thrown in contact with him gave of his work in these positions, which require so much knowledge, skill, tact and good judgment to fill successfully and satisfactorily. He was called to the position of assistant secretary of agriculture by President Harrison because of the personal knowledge of the President of his true worth. Owing to the ill-health of Secretary Rusk, and the demands made upon his time by other duties, Mr. Willits was called upon to perform the duties of the secretary much of the time. So well were these duties performed that Secretary Morton was reluctant to dispense with his valuable services. The world is better for his having lived. He did much good while living, and his life is an inspiration to the young men who knew him either as a teacher or in performing the various duties of his busy life, showing that industry, integrity and perseverance are the cardinal principles of life, in the exercise of which any position in life is possible.

EDWIN WILLITS AND THE NORMAL SCHOOL.

PROF. DANIEL PUTNAM, YPSILANTI.

The faculty of the State Normal School desire through me, as their representative, to unite in this public and appropriate recognition of the valuable and faithful services rendered to our State by the Hon. Edwin Willits. In the natural division of duties in these memorial exercises it properly falls to me to speak only of his relations to the Normal School and of his services in connection with that institution.

The school, as you know, is under the immediate control of the State Board of Education. In fact this board was originally created mainly for the purpose of locating the institution and managing its affairs. Gradually its functions have been enlarged, but for several of the early years of its existence it hardly did more than to guard the interests and provide for the welfare of the school. In a board limited to the small number of four, each individual counts for more than in a body of larger membership. The personality of the members comes to be better understood by the faculty, and the influence of such personality makes itself felt in the direction of affairs more readily and more obviously. Mr. Willits became

A MEMBER OF THE BOARD OF EDUCATION

at the opening of the year 1861, and served continuously for twelve years. At the commencement of his term of office the school had been in operation but eight years, and was still in a formative condition. Associated with such men as Witter J. Baxter, John M. Gregory and Oramel Hosford, Mr. Willits exercised a strong influence in giving direction to the internal organization of the institution, and in the selection of members of the board of instruction. His period of service on the board covered the last years of the administration of Principal Welch, the whole of the administration of Principal Mayhew and the first years of the administration of Principal Estabrook. During these years the character of the school became established; its reputation steadily increased; and its influence upon the educational interests of the State grew more and more potent. Mr. Willits contributed his full share of energy and effort toward the production of these results. He had the confidence of the school and of the faculty, of the people and of the successive legislatures upon whose appropriations and good will the institution depended for its means of support and progress. The teachers, who remained for any length of time in the school came to know him, not only as an official of the governing body, but also as a personal friend and a wise and valued adviser. Without exception they regretted that other duties compelled him to decline a third election and six years of additional service on the board.

After the severance of his official relations with the institution, and while a member of the national house of representatives, he still retained and manifested a warm interest in its prosperity, and remembered it in the distribution of valuable public documents and in other substantial ways.

PRINCIPAL OF THE NORMAL SCHOOL.

At the close of his two terms of service in congress, and ten years after his retirement from the Board of Education, he was elected by that board to the principalship of the Normal School, and was inaugurated in June, 1883. The considerations which influenced the board in inviting Mr. Willits to take executive charge of the institution are thus stated in their report:

"In appointing to so important a position as the principalship of the Normal School one whose life work had been in other callings than the profession of teaching, one who had not through experience and study a systematic course of pedagogy behind him, the board were mindful

that they were departing from the ordinary course of procedure; but they desired especially to emphasize that clause in the legislative action of this State, which, in instituting a Normal School for the preparation of teachers, required that the State Board of Education should also provide for the instruction of its pupils 'in the fundamental laws of the United States, and in what regards the rights and duties of citizens.' With this in view, no one seemed to the board to combine, as Mr. Willits does, so many of the requisites necessary to lead the Normal School on to that great future which its founders confidently expected for it. * * * For full twenty years he was a leading member of the local board of education of Monroe; for twelve years (from June 1, 1861, to December 31, 1872) he served as a member of the State Board of Education, in which position he became familiar with the affairs of the State Normal School; in the State Constitutional Commission of 1873 he served as chairman of the committee on education. His scholarship and scholarly tastes, his large experience, his acquaintance with men and affairs, coupled with his thorough knowledge of the subjects assigned to him to teach, justify, in the opinion of the board, their going outside of the profession of teaching in selecting a man for the responsible position of principal of the State Normal School."

HIS TEACHING WAS FOR BROADER AND BETTER CITIZENSHIP.

In entering upon his duties in the school Mr. Willits kept in mind the department of labor which the board, in effect, had marked out for him. He gave instruction in civil government, in constitutional law, in the forms of congressional procedure, and in other subjects which touched upon social relations and upon the rights, duties, and obligations of citizens. He brought into the institution somewhat more of the tone and spirit of practical and political life than had been in it before. He emphasized the fact that the teacher is also a citizen, and, in common with his fellow citizens, should be concerned in the management of public affairs,—should be, in the highest and best sense of the word, a politician and a "man of affairs." There was some room and some occasion for teaching in this direction, for affirming that one does not forfeit his rights as a freeman and a citizen when he enters the school room as a teacher; that freedom of speech and freedom of political action still remain to him; and that with this freedom there remain also the responsibilities which rest upon men in other positions and in other employments. These responsibilities the teacher is not at liberty to refuse or to evade. His manhood is concerned in cheerfully assuming them and conscientiously discharging them.

While thus emphasizing the political and social aspect of education Mr. Willits recognized fully the transcendent importance of the moral element in the curriculum and instruction of the school.

IN HIS INAUGURAL ADDRESS HE SAID,

"The time is coming when we must choose between the policeman and the moral sense. In all ages the best policeman has been a well-regulated conscience—and this implies intelligence combined with moral sense. It is cheaper in the long run for men to govern themselves. In a republic, its citizens must govern themselves, must be their own restraint; if not,

it ceases to be. How then is this self reliance, this self restraint, this well-regulated conscience to be secured? Manifestly the pathway to it lies through our education. And of what shall this education consist? An education that includes only intelligence may foster crime, may sharpen its tools. Lieber appreciated the distinction fully when he declared that, 'A widespread and sound education is indispensable to liberty. But it is not liberty itself, nor does it necessarily lead to it. * * * Education is almost like the alphabet it teaches. It depends upon what we use it for. Many despotic governments have found it their interest to promote popular education, and the schoolmaster alone can not establish or maintain liberty, although he will ever be acknowledged as an indispensable assistant in the cause of modern freedom. Liberty stands in need of character.'

"Let me," said Mr. Willits, "repeat it; liberty stands in need of character. Let us write on the walls of our school room, liberty stands in need of character. Let us write the words on the door-posts of our habitations. What we want is character; what we must have is character. And what is character? It is that something so subtle that laws cannot define it, nor constitutions evolve it. It exists above them both and behind them both. They exist themselves only because of character, and manhood, and right. It is this intangible something that stands by the side of the pulsations of our hearts, and construes all law, and obeys justice, and right, and truth; that is so sacred that in the end it will stand in the presence of Divinity, in his likeness.

"Now, how is this character to be developed? The education Lieber refers to includes only the intellect. The education we want must include the moral sentiments as well. * * * The generation now on the threshold, and the generations to follow, should be taught morality as affirmatively as arithmetic—not negatively, but affirmatively, that sin is sin; that drunkenness and lust, and profanity and lying, and theft and murder, are all wrong, and lead to a bad end; and that good order, respect for law, and temperance, frugality, honesty, purity, and reverence for the good and true, are all elements of a perfect manhood and womanhood."

I have quoted this language of the Board of Education to show as clearly as possible what was expected of Mr. Willits in his position at the head of the Normal School; I have quoted from his own words, when entering upon his duties, to show the spirit of the man, and his conception of the nature and quality of the education needed by the young men and young women who go out to fashion the minds and inspire the hearts of the children of our State. He believed that the best preparation of the teacher for his work was intelligence permeated by moral principle. He did not undervalue the technical utterances of the science of education or of the art of teaching, but he recognized the great truth that these, unless animated by a living soul, were of little worth.

The connection of Mr. Willits with the Normal School was too brief to allow him to establish any new policy for its management, or to seek to change, in any radical way, the character of its instruction or the curriculum of its studies. He labored honestly and earnestly to advance its interests, to enlarge its sphere of usefulness, to give greater efficiency to its work, and to give it a stronger hold upon the confidence and good will of the people of the State. In these directions his administration

was eminently successful. The school prospered under his direction, increasing in numbers, in general character, and in the extent of its professional instruction.

He commanded the respect and confidence of his associates in the institution, and carried with him, when he resigned the principalship, their affection and kindly remembrances.

The faculty of the school and the students who knew him gladly unite in these services in his honor, testifying in this way to his nobility as a man, to his integrity and uprightness as a citizen and public officer, and to his worth and worthiness as an associate and as a friend.

PRESIDENT WILLITS FROM THE STUDENTS' STANDPOINT.

H. B. CANNON, '88.

When Mr. Willits came to the Agricultural College the student body almost at once recognized in him a master hand in administration. There was an atmosphere of hope about him. He came with splendid plans to execute; his eminent attainments and honors captured our imaginations. We felt that the old College was at the dawn of a new era. The students were proud of their president, and felt sure that his influence with the great world outside would bring again to the doors a stream of students. Our hopes met with realization; more students, more departments of instruction and more buildings we saw as time went on.

To the students Mr. Willits stood as an example of a great man. He had made a name for himself and won reputation in the hard school of the statesman and law giver. He now essayed feats in executive lines. His judicial fairness and firmness brought him respect. His sympathy with the victims of disorder or his hatred for its perpetrators was such that he won our love. The venerable look of the man, his fatherly ways, his eagle's eye—all impressed us and moved us. We believed in President Willits; and I am sure he knew it, and that the thought did him good.

He had been a poor boy and his sympathy was quick to note the struggles of the poorest of us, and come to us in ways of helpfulness. He had made sacrifice for an education, so understood the meaning of a thirst for knowledge. He gave praise and counsel as he might. The president's "Well done, my lad," rang in one's ears for weeks, so hearty and stimulating was the tone of his voice. Not only did President Willits believe in the College and the students, but he trusted to the good sense of the people to support the College when it could be properly brought to their notice. The Farmers' Institutes afforded him a chance where his skill as a speaker might do great good. The result was that he captured audience after audience to the great satisfaction of his student admirers who believed so heartily in his prowess and wisdom.

Through all the four eventful years there was not an hour in which the good man felt quite at peace. While College was in session there was always danger that the restless spirits might give trouble and then the "Institute" season or the legislative session with its burden of care followed. "I never slept without fearing that something might go wrong," he once told me. And many a night when we were sound asleep our noble president was pacing the campus, keeping watch and ward.

We knew him as a man of method. He tried to encourage order and cleanliness in every way. I recall his house-cleaning day plans, and his dust bin arrangements as examples. He knew, too, that clean walls and fresh paint inspired respect, and how tidiness in person made for order. "You never heard of a mob in good clothes," was a saying I recall.

He had no need to run a card catalogue of his friends; he could remember them whenever he might help them; and they do not forget him now.

"Whether one met him but for the day, or came to know him intimately, he could not fail to be impressed by his friendliness and power," testifies one of the Detroit alumni.

HE REMEMBERED HIS M. A. C. BOYS.

When he was called to be assistant secretary of agriculture we found that he could remember his M. A. C. boys and that in his new post of honor and influence he could add to the reputation of our College. As an officer he was careful, courteous, patient; yet the same largeness of plan marked his work as had been the case at M. A. C. For this view he often gave Professor Bailey the credit (doubtless also shared by others of the new school of scientists). The thought of the relation between the created thing and its environment seemed ever with him. He hoped to see a competent man monograph the cereal and textile exhibits which were collected for the World's Fair by the government. This work of making an exhibit which should illustrate the function of the Department of Agriculture, was placed in his charge. He also was named as chairman of the government board, and a great deal of his energy and thought did he put to this task. He held the plow to mark the site where the government building should stand, and that established the Jackson park site. No one not familiar with it can judge of the work required at his hand before the task of preparing, installing, exhibiting and taking down again of that government exhibit was over. There were various inharmonious elements to keep within bounds, to hasten the necessary labor.

The work done at the department proper, while more in the nature of routine business, had a breadth of scope and called for its proper management so large an amount of knowledge that the ordinary run of public men, congressmen and others, would have felt uncomfortable in the place for months, had President Harrison been careless in the calling of a man to the post.

In the administration of his office Mr. Willits won confidence and love. "His leading trait is sympathy," one officer said to me, and perhaps that was a correct statement. "But," he added, "confound it, he will sympathize with both sides. He won't take your part and forget the other fellow." That trait of impartiality won him love.

NOTES FROM W. A. TAYLOR.

In response to request, Mr. W. A. Taylor, '88, now assistant pomologist in the Department of Agriculture, sends me some notes. I am very glad to give them. They cover certain periods much more accurately than I can do; and none could speak more lovingly.

"The incident," says Mr. Taylor, "which doubtless is most clearly remembered by the students then in attendance, was the occasion of Mr.

Willits' first appearance at the College in the capacity of president. The student body was in a quiver over the mistreatment of one by others, at the time unknown; wild rumors of intended severe and sweeping punishment of suspected students were in circulation and many were of the opinion that affairs had reached a stage where it was useless for young men in search of education to longer remain at the institution where quiet and continuous work was out of the question. The crisis was upon us—would the man be equal to it? It was a crucial test of the new president, but the outcome of it was a most complete and prompt restoration of the confidence of the students in the wisdom and intent of the faculty. The first chapel exercise settled the whole question whether there would be co-operation or rebellion, and though proper regard for the future caused the suspension or expulsion of several students, even their warmest friends acquiesced in and admitted the justice of the action taken.

"I have not known another man of such strong views as his who was at heart so tender and merciful. The culprit sentenced by him recognized this and rarely resented the punishment which justice made necessary.

"This was, I think, the chief secret of his personal hold upon students and alumni. He felt strongly and admired strongly marked personality. In his own words in the address before the College Y. M. C. A. in 1886, on 'Affirmative Religious Principles,' which, by the way, is worthy of preservation by every M. A. C. student, 'I have no sympathy with a negative. I do not like negative men or women. The world may make something out of a rascal, but out of a fool, never.' And yet I doubt if ever a weakling found a more sympathetic or more helpful friend than he.

"He never permitted the larger affairs of the College management to blot out the remembrance of small things, which were essential to the welfare of students, and often risked his health and encroached upon his stock of reserve force in order that he might give his personal attention to little matters which most of us thought at the time unimportant, but which we have since then come to realize the necessity of. If a student was ill at the College, Mr. Willits seemed to charge himself personally with the responsibility for his proper care and attendance, and if, as sometimes happened, death entered the student family, no more sincere mourner followed the bier than he.

"One of the most vivid pictures of him in my own mind is connected with the death of Gilbert in '88, when at midnight with the aid of two or three whom he had notified, he carried the body of the dead boy down from the top floor of Wells Hall [to Taylor's room], and after preparing it for burial, watched with the rest till day dawned. It was not more than any one of us would do for his comrade, but how many of us, bearing the heavy responsibility of head of such an institution, would be found at hand in such an emergency!

"It has always seemed to me that it was this thoughtfulness for others that gave him such a strong hold upon the affections of his students. It did not cease when the student left college, as many of our fellow alumni can testify. Nor was it confined to his students, for among his associates during his last years, in church, business and political as well as in the many and varied educational and scientific organizations with which he was connected, the same grief is felt at his death.

"He was a man whom his students could respect without fearing, and whom they loved for his own sake. The thought that we shall not look into those kindly eyes again nor feel the hand clasp of our friend brings up so many recollections of his merit and goodness that the pen fails to keep pace with memory."

I recall one sentence from a sermon of his, "Tell me what a young man does with his leisure and I will tell you whether the blazes along his life's pathway lead to the pestilential swamp or the mountain height." This is a characteristic statement; yet I think the lines apply to him—

"His life was gentle; and the elements
So mixed in him that nature might
Stand up and say, This was a man."

Edwin Willits by the grace of God was a Christian gentleman. His memory is sweet. Remembering the beauty and goodness and blessing of his life, who may not with reverence exclaim of it, "What God hath wrought."

LETTER FROM CYRUS G. LUCE.

I am in receipt of your invitation to attend the exercises to be held at the College in memory of Hon. Edwin Willits on the 19th inst. It would afford me a melancholy pleasure to join with others who knew the worth of our departed friend in doing honor to his memory.

Some men do well in some one line of life's work. Mr. Willits did well in all lines. He was a success as an attorney. As a member of congress he won high rank. At the Normal School his memory is treasured for his many excellencies. At the Agricultural College he won high renown. But the best work of his life was performed in the department at Washington. He brought to a discharge of his duties all of his powers of body and mind. He walked here in untrodden paths. He was the strong man who upheld the arms of the secretary.

Largely through his diligence, skill and ability the new department was made a success. Mr. Willits was not only a great man, but in all the relations of life he was a good man. He was, in the broadest and best sense, a Christian.

He is gone, but his friends can well rejoice that his many good works will live after him.

PERSONAL RECOLLECTIONS OF EDWIN WILLITS.

DR. R. C. KEDZIE.

My acquaintance with Edwin Willits began by letter in the latter part of the sixties.

I made his personal acquaintance in 1873 when he was a member of the commission of eighteen appointed by Governor Bagley to revise the State constitution, said revision to be submitted to the next legislature for their approval, to be submitted by them to the vote of the people for ratification or rejection. In this commission Mr. Willits was made chairman of the committee on education. He had been so long time a mem-

ber of the Board of Education that it was eminently fit and proper that he should take the leadership in the important matters of education in this State. This was the first committee to report on amendments to the constitution, and its report was adopted, constituting section XIII of the proposed constitution.

During all the deliberations of the commission the people were pleased with the broad and statesman-like views of this body of eminent men, and especially delighted with the liberal views of the committee on education, providing for all the educational interests of the State.

The revision of the State constitution by this commission was excellent in principle and form, but when it fell into the hands of the next legislature it was torn to pieces, and when its mangled remains were submitted to the people, they mercifully buried them out of sight by an overwhelming adverse vote.

ELECTED PRESIDENT OF THIS COLLEGE.

In January, 1885, he was elected president of the Agricultural College, but as he was then principal of the State Normal School, he did not enter upon his duties till the following July. In the preceding November, President Abbot had tendered his resignation to the board on account of broken health, but continued to discharge the duties of president till his successor should arrive.

HIS WORK AT THE AGRICULTURAL COLLEGE.

President Abbot has been appropriately called the formative president of the Agricultural College. Under his hand the Agricultural School became the Agricultural College, and the agricultural course received its enduring features under his administration. In like manner it must be said that President Willits organized and put into active work the Experiment Station, and that he was the creator of the Mechanical Course in this College.

THE EXPERIMENT STATION.

The Hatch bill providing for Agricultural Experiment Stations in connection with the agricultural colleges in the several states was passed in the early part of 1887. A meeting of representatives of the agricultural colleges and experiment stations was held in Washington in August of that year to determine upon the scope of the experiment stations, and their relations to the agricultural colleges. In this convention there was a powerful clique that strove to give the experiment station such a trend as would divorce it entirely from the college. They maintained that the experiment station must have no connection with the college—separate buildings, apparatus and experimental farms; that no professor giving instruction in the college should have anything to do with the station.

A committee of nine was appointed to formulate plans, largely made up of persons who held these extreme views of the supreme importance of the director. President Willits was the minority in this committee. When the greatness and dignity of the director were urged in the committee, President Willits raised this query: "There are thirty-nine experiment stations: where will you find thirty-nine men of such worth and experience as will properly command a salary of $5,000 a year?" One of

the committee glanced around the room and smilingly answered, "I think there are nine such men in this room."

The committee reported their plan for the entire separation of college and experiment station, and the members urged on the floor of the convention the impropriety of any person holding office both in college and station—that no man could serve two masters, etc.

President Willits argued that the experiment station was the corollary of the college—that the two were parts of a whole in the educational system of the state; that the theoretical instruction in the class room should be carried into the laboratory, the farm and the garden, there to be verified or refuted, and the results then given to the public in the bulletins of the station. So clearly did he present this logical connection of the college and the experiment station that the convention rejected the plan of the committee by a decisive vote, and adopted the plan of co-operative work carried out in this College and in most of the agricultural colleges of this country.

As evidence of the favor with which Michigan regards this combined work of college and station I simply call attention to the fact that the yearly issue of twelve bulletins of 20,000 each scarcely supplies the popular demand. There is no part of the work of the College that brings it so completely in touch with the people of the State as the investigations and bulletins of the Experiment Station. In starting this work and giving it the right direction, President Willits did much for the State and the whole country.

THE DEPARTMENT OF MECHANIC ARTS.

This institution was originally established as the Agricultural School, and for many years the trend of instruction was entirely in the line of agriculture in its broad sense. The Morrill act of 1862 provided a fund "for the endowment, support and maintenance of at least one college where the leading object shall be to teach such branches of learning as are related to agriculture and the mechanic arts." When President Willits took charge of the College he announced that it was time that the mechanic arts should come to the front on a par with agriculture. His aim was to add the mechanical course to the College curriculum without impairing the efficiency or lowering the attendance of the agricultural course. The results justified his assumption, for there was an increased attendance in the agricultural course at the same time with the influx of a large number in the mechanical course. The average attendance for five years in the agricultural course before this change was 193; the average attendance on the same course for five years after the mechanical course was introduced was 227, an average gain of 34 for this course, while the attendance on the mechanical course reached an average of 120 when it reached all the College classes. The average total attendance by five year periods passed from 193 to 328. This shows an advance all along the line, and not the crippling of one course to build up a rival.

President Willits took hold of this work of building up the department of mechanic arts with energy. He visited the shops in Detroit and other manufacturing cities to place before this constituency the advantages of the course of scientific and practical training at the College and inviting the shop boys to secure the advantages here offered. There was soon a

large influx of students; the College halls were soon filled to overflowing, and his own house—"the castle on the hill"—was crowded with enthusiastic students. This was no sudden boom, to flare up in sudden blaze and go out in more painful darkness, but the impetus then imparted to the College has continued to this day. It is not too strong language to say that he made the new course and planted it upon an enduring basis, yet strengthened and enlarged the old course. He did not build up by tearing down.

PERSONAL CHARACTER.

The personal character and influence of President Willits were strong elements in his success. He knew every student, could call them by name and recognize them wherever found. He visited them in their rooms, knew their history, and recognized their individual peculiarities, difficulties and temptations. By a wonderful intuition he seemed to enter into the life of every student, and his care over them was almost sleepless. He once told me that he never retired for the night without first going the rounds of the halls to see that everything was safe and quiet.

One element of his success was his religious character. Edwin Willits was a whole-hearted Christian. A staunch Presbyterian, he let his light shine before men. During his presidency there was no line of street cars from the College to Lansing by which students could attend divine service in the city churches. For many of the students the morning hours of Sunday were aimless and idle. To remedy this he instituted a series of Bible talks for 9 o'clock Sunday morning, which were such a treat, intellectually and morally, that the chapel was soon crowded with delighted listeners. The Sunday afternoon services by the clergymen of Lansing were continued, not because 2:30 p. m. was an ideal hour for worship, but because the ministers of Lansing could not be secured for other hours. Attendance was not compulsory, yet the chapel was well filled; the Sunday school and Bible classes were well attended and the moral and religious atmosphere at the College was healthy.

In recalling the history of those who have been pillars in the College edifice but who have passed away, one is painfully reminded of the evanescence of human life.

"One by one the roses fall."

One by one the oaks come down. President Williams, Secretary Howard, Judge Wells, Secretary Baird, President Abbot, President Willits. How fast they pass away. Yet June returns with its roses, and though the oak must fall the forest lives on. So the College. Though the great leaders pass beyond, the College remains—a beneficence for the present and a hope for all coming time.

DEATH OF PROF. A. N. PRENTISS, '61.

We are indebted to Prof. A. G. Gulley, '68, of Storrs Agricultural College, Storrs, Conn., for the following item regarding Prof. Prentiss, who died at Ithaca, N. Y., August 14, 1896. Prof. Gulley was at one time a student under him at M. A. C.:

"No doubt you will have been informed of the death of Prof. A. N. Prentiss before receiving this. Early in July, I spent a day at Cornell and in the evening spent a half hour with him. I felt then it would be my last visit with him, but did not think the end was so near. Although Prof. Prentiss closed his labors at M. A. C. over twenty-five years since, his interest in the old institution was as great as ever. He was particularly anxious to learn about those with whom he was connected there, both officers and students; and spoke especially about the Record and the pleasure he derived from reading it.

"Prof. Prentiss was born May 22, 1836, at Cazenovia, N. Y. He graduated in 1861 from the Michigan Agricultural College, and in 1865 was made full professor of botany in that institution. On the opening of Cornell University, in 1868, he was called to the chair of botany, horticulture, and arboriculture, which he had held ever since.

"Prof. Prentiss conducted the Cornell expedition to Brazil in 1870. In 1872 he studied in the Royal Botanic Gardens at Kew in London, and the Jardine des Plantes at Paris. He was a well-known writer in his branch of science, and in 1872 his essay on the mode of the natural distribution of plants over the surface of the earth took the Walker prize offered by the Boston Society of Natural History, and was published in pamphlet form. Prof. Prentiss was well known throughout the scientific world as one of its leading botanists, and his death is a great loss to the university, as well as to the scientific world."—From M. A. C. Record.

AGRICULTURAL COLLEGE.

COMMENCEMENT, JUNE, 1897.

EXERCISES OF THE WEEK.

Sunday, June 13, 2:30 P. M.

Baccalaureate sermon by Rev. Bastian Smits. Subject, "The Unity of Life."

Tuesday, June 15, 8:00 P. M.

Contest in oratory and debate among representatives of college literary organizations.

CONTEST FOR ORATORS' MEDAL.

"Co-operative Government for America"......T. A. Chittenden, Columbian Society
"Music and its Influence"....................Miss Pearl Kedzie, Feronian Society
"Education our Safety"..........................Elwood Shaw, Olympic Society
"The Power of Public Opinion"..........A. B. Krentel, Phi Delta Theta Fraternity

CONTEST FOR DEBATER'S PRIZE.

Question for debate—"Resolved: The Luxurious Prodigality of the Rich in their Private Life is Advantageous to Society."

Affirmative ....A. T. Cartland. Hesperian Society
Negative..................................F. W. Robinson, Union Literary Society

Wednesday June 16, 10:00 A. M.

CLASS DAY EXERCISES OF THE GRADUATING CLASS.

President's Address ....S. H. Fulton
History...C. B. Laitner
Oration ....Elwood Shaw
Paper ....E. C. Green
Prophecy ....Miss Sadie Champion
Poem ....J. D. McLouth

3:00 p. m.—Review of the battalion.
8:00 p. m.—Reunions of College Literary Organizations in their rooms.

Thursday, June 17.

ALUMNI DAY.

Twelfth Triennial Reunion of the Alumni Association.

8:00 a. m.—Business meeting.
10:00 a. m.—Literary exercises:

President's address	M. D. Chatterton, with '61
History	Warren Babcock, '90
Necrology	L. A. Breggar, '88
Oration	C. B. Collingwood, '85
Poem	J. E. Hammond, '86

12:00 m.—Alumni banquet, to be served by students of the Domestic Science Department.
3:00 p. m.—Exercises celebrating the fortieth anniversary of the establishment of the College:

Address	Hon. C. J. Monroe
Poem	Frank Hodgman, '62
Address	Hon. George Willard

Impromptu addresses.
5:00 p. m.—Business meeting alumni (election of officers).
8:00 p. m.—President's reception.

Friday, June 18, 10:00 A. M.

COMMENCEMENT DAY.

Address, "The Agriculturist of Tomorrow"	J. W. Rigterink
Address, "The Tendencies of Steam Engineering"	E. H. Sedgwick
Address, "The Agricultural Status"	L. H. Bailey, Professor in Cornell University

Presentation of awards in the contest of June 15.

Conferring of Degrees.

ANNIVERSARY EXERCISES.

COMMEMORATING THE FORTIETH ANNIVERSARY OF THE OPENING OF THE COLLEGE, MAY 13, 1857.

Exercises commemorating the fortieth anniversary of the opening of the College, were held in the College chapel on Thursday, June 17, 1897, at 3 o'clock p. m.

Hon. C. J. Monroe, vice president of the board, presided. Mr. Monroe was a member of the first class at the College.

Hon. Geo. Willard of Battle Creek, who was a member of the State Board of Education in 1857, then in charge of the College and who was also present at the opening, delivered the address.

Mr. Frank Hodgman, class '62, read a poem, "Forty Years Ago." Short addresses were delivered by Hon. William Ball, president State Agricultural Society; Hon. Geo. B. Horton, master State Grange; Hon. J. T. Daniels, president State Association of Farmers' Clubs; Prof. James Satterlee, class '69; Prof. W. C. Latta, class '77.

FORTY YEARS AGO.

FRANK HODGMAN, '62.

[Written for the Fortieth Anniversary of M. A. C.]

How swift the rolling wheels of time, dear chum, have sped along
Since that old bell's sweet loving chime first cheered us with its song.
As we were toiling on our way with footsteps tired and slow,
Along the muddy road from town some forty years ago.
Forty years ago: Forty years ago:
It does not seem that it can be quite forty years ago.

Full many a lad from far and wide had spent the night in town,
And with the early morning tide were off for College bound.
And, as we crossed the river Grand, we watched the bubbles go
Beneath the wooden bridge that spanned it forty years ago.
Forty years ago: Forty years ago:
The river seems much smaller now than forty years ago.

When half the toilsome way was passed, we rested by the stone
Within whose cleft a cherry pit had taken root and grown;
The cleft was not so very wide; just half an inch or so;
The little tree scarce touched its side some forty years ago.
Forty years ago: Forty years ago:
The cleft has spread; the tree has grown since forty years ago.

Just as we reached the river bend we heard the college bell:
Its mellow tones, so rich and clear, came o'er us like a spell.
With quickened footsteps on we sped, in answer to its call,
Along the winding road which led us to the college hall.
Forty years ago: Forty years ago:
With many a crook and turn, it led us, forty years ago.

We went along the bluffy bank, the Cedar rolled below;
Then past the red brick cottages all standing in a row;
Past pits of clay and piles of brick still standing in the kiln,
And o'er a rude and rustic bridge across a little rill.
Forty years ago: Forty years ago:
Great green oak stumps stood all around here forty years ago.

A path led past the college hall and close beside the well,
Across from which a sturdy oak upheld the college bell;
It ended at the boarding hall which had no name, you know
We did not call it "Saint's Rest" then; not forty years ago.
Forty years ago: Forty years ago:
The saints all lived in later times than forty years ago.

They called us in, examined us; they questioned us like sin,
Because there were so many boys we could not all get in.
And some were quickly sent away, it made them sad to go,
But happy we who stood the test some forty years ago.
Forty years ago: Forty years ago:
It seems but just a little while since forty years ago.

'Twas Williams, Tracey, Fisk and Holmes who questioned us that day,
And Enoch Bancker helped along a little in his way.
The questions came in various ways. From Fisk we'd seldom know
If right or wrong we'd answered him, some forty years ago.
Forty years ago: Forty years ago:
He's been a college president since forty years ago.

That day he asked a likely lad about his mother tongue;
"Is English language flexible?" The answer quickly rung;
"The way that you ask questions, sir, it surely must be so."
And then the boys all cheered and laughed, some forty years ago.
Forty years ago: Forty years ago:
Prof. Fisk could give or take a joke some forty years ago.

And when at last we settled down to study and to work,
Prex Williams lectured to the boys and taught them not to shirk.
No matter what his subject was, his lecture would be half
On pretty points he pointed out about his blooded calf.
Forty years ago: Forty years ago:
That calf stood high in Prexy's eye some forty years ago.

We chopped and logged and cleared the ground, we cut down lots of trees,
And once upon a time we found one with a swarm of bees,
We took its store of sweetness in, a hundred weight of honey
Which went in triumph to our rooms; we thought it very funny
Forty years ago: Forty years ago:
Next day we did not feel so well, some forty years ago.

And when we had the surface cleared, we plowed and dragged it down,
With heavy teams and working tools that mellowed up the ground.
We hoed the corn, we cradled wheat, we used the scythe to mow,
For that's the way folks had to do, some forty years ago.
Forty years ago: Forty years ago:
Machines were scarce and costly then, some forty years ago.

We had some tools of wondrous make to mellow up the ground,
But one big harrow "took the cake" from all the tools around.
The teeth were full two inches square and eighteen inches long:
It took two heavy teams to pull the monstrous thing along.
Forty years ago: Forty years ago:
That big State drag just beat them all some forty years ago.

When neighbor Harrison saw the tool he gazed on it with awe;
"A bigger drag than that State drag," he said, "I never saw.
If that's a State drag what a drag the Nation's drag must be,
And when they use it in the fields, may I be there to see."
Forty years ago: Forty years ago:
I wonder where that drag has gone, since forty years ago.

One day to show them that we could, we started out and found
The biggest monarch of the wood in all the country round;
And then, with axes keen and sharp, we laid the monarch low;
They called us vandals for that lark, some forty years ago.
Forty years ago: Forty years ago:
We wish we had not cut that tree some forty years ago.

We pulled up all the green oak stumps that stood about the lawn
And when at last we had them out, we wished that they were gone,
For every stump brought tons of earth; it took us many a day
To pick it from the pesky things, and draw the stumps away.
Forty years ago: Forty years ago:
We could not burn the stumps we pulled out forty years ago.

And then we sowed that turnip seed. The yarn went all around
About such lots and lots of seed sowed on so little ground;
And as it grew, each mother's son who went along the plank
Declared the College must be run by some half-witted crank.
Forty years ago: Forty years ago:
The lies were thicker'n turnip plants were forty years ago.

We wandered all the country round, by woods, and fields, and lakes,
Wherever insects could be found, or birds, or fish or snakes;
We gathered in a lot of them; most anything would go
Into the College Museum some forty years ago.
Forty years ago: Forty years ago:
I wonder if they've kept them all since forty years ago.

We tussled hard with grammar and with rhetoric and logic,
Philosophy and chemistry and algebra and physics,
But when we had geometry, they cut our class in two;
To hear us all within an hour was more than they could do.
Forty years ago: Forty years ago:
'Twas then we had a merry strife, most forty years ago.

The classes came at different hours; the theorems were the same.
Who'd demonstrate most in an hour, the victory could claim.
We tried it for a week or more; each class would winner be,
But they gave up at eight-four, when we did ninety-three.
Forty years ago: Forty years ago:
That made Prof. Tracey proud of us some forty years ago.

We studied trigonometry and did some land surveying;
We mixed up physiology with harvesting and haying;
We studied horticulture 'mid the turnips and tomatoes
And spent our time at botany 'mid posies and potatoes.
Forty years ago: Forty years ago:
We had to work and study both, some forty years ago.

The jolliest time in all the year was when we went to town
And visited the Fem. Sem. girls, each in her prettiest gown;
But things have greatly changed since then; the Fem. Sem. had to go.
It's been a school to teach the blind since forty years ago.
Forty years ago: Forty years ago:
Miss Rogers had some splendid girls there forty years ago.

Once in the pleasant summer tide, a balmy eve in June,
Prof. Abbot brought his bonny bride; we sang for them a tune.
'Twas "Take her but be faithful still." We sang it sweet and low
Amid the drooping evergreens, some forty years ago.
Forty years ago: Forty years ago:
How well we loved and honored him 'most forty years ago.

And then came on the anxious days when all the air was rife,
With rumors of the Southern craze, which sought the nation's life;
When Lincoln ran for president and Seward spoke in town,
We organized a Lincoln club and all of us went down.
Forty years ago: Forty years ago:
We nearly all were Lincoln men some forty years ago.

We went in farmer's uniform, to stand up for the law,
In wampus blue and overalls and jaunty hats of straw,
On wagon racks and horses backs, or any way to go,
The day that we heard Seward speak 'most forty years ago.
Forty years ago: Forty years ago:
He shook our hands and we felt grand 'most forty years ago.

Then came the weary evil days of civil war and strife,
And some of us went marching out to save the nation's life,
And some came back with honors crowned, and some were stricken low;
They've lain at rest in Southern ground since forty years ago.
Forty years ago: Forty years ago:
We've sung for them a requiem, since forty years ago.

And now, dear chum, we're here again upon the same old ground,
But nothing seems the same to us except the bell's sweet sound.
We came upon a trolley car, ten minutes ride or so,
It is not like the walk we took some forty years ago.
Forty years ago: Forty years ago:
It took an hour to walk from town some forty years ago.

New buildings stand on every side, new faces all around
The Co-ed beats the Fem. Sem. girl we used to meet in town.
I cannot find the boarding hall; I need some one to show
Me where the places are I loved so, forty years ago.
Forty years ago: Forty years ago:
It does not seem such change could come since forty years ago.

I miss our old time faculty. Not one of them is left.
Of all the men who taught us then, I feel like one bereft;
For some are sped and some are dead; there's little left to show
Of all we loved and cherished here some forty years ago.
Forty years ago: Forty years ago:
It seems just now as if it was a hundred years ago.

But through all changes that have passed and all that yet may come
Our hearts still fondly turn at last to our old College home.
She is our joy, our hope, our pride, no other place below
Can warm our hearts as she has done since forty years ago.
Forty years ago: Forty years ago:
Our hopes and prayers have been for her since forty years ago.

NEWER EDUCATION.

MICHIGAN FOREMOST IN THE MODERN EDUCATIONAL SYSTEM. THE MICHIGAN AGRICULTURAL COLLEGE ONE OF HER NOTABLE EXPERIMENTS.

AN ADDRESS DELIVERED BY GEORGE WILLARD AT THE COMMEMORATION OF THE FORTIETH ANNIVERSARY OF THAT INSTITUTION.

Mr. President, Members of the State Board of Education, Faculty, Alumni, Students of the Michigan Agricultural College, and Citizens:

We commemorate the fortieth anniversary of the first endeavor to occupy the field of higher education with an institution possessing the peculiar features of the Michigan Agricultural College. As one who had a part, however small, in launching an experiment which has led to such gratifying results, it would be an exhibition of culpable indifference in me not to appreciate the honor of an invitation to participate in this event. It is but just to also add that the hopes indulged when this College was founded have been fully realized. The reality has even gone much beyond the expectancy of at least many who projected and inaugurated an undertaking which bore in many quarters the imputation of being injudicious and hazardous.

GENERAL RETROSPECTIVE GLANCE.

It must be remembered that this trial was made under quite different conditions from those which exist now. History has been recording marvelous changes since this College was established. Forty years in this age of progress has measured an important cycle in the world, in our country, and in our State. When this institution took its place as a seat of learning in 1857, there was no cable communication with Europe or other lands beyond the sea. France, now for a quarter of a century a firmly established republic, was then under the second empire; Italy had not united the fragments into which she had been torn by the factions and the superstitions of the middle ages; Prussia, still a kingdom, had several years to wait before expanding into the Imperial Germany of our time; Russia was then weighted with serfdom and shadowed with her flag a portion of North America; Japan and China were practically outside of our American diplomacy; the most powerful nation of South America had a monarch on a hereditary throne; and Canada had not assumed to be the Dominion. In our country, California, then recently acquired from Mexico and admitted into the Union, was the only state west of the Missouri river; Buchanan had just entered upon his four years' presidential term, and human slavery, by federal toleration, and we may say compact, darkened a portion of our country and well nigh dominated the whole; a great chapter in our national history was yet to be delayed in its opening for four years and many of our chief national

characters had hardly emerged from the level of common life. Lincoln had acquired some fame, but had yet to win a greater distinction in the debate with Douglass; Grant was farming near St. Louis; Garfield had just left college; Blaine, a youthful journalist, was editing a newspaper in Maine; Edison, the world's greatest electrician and the greatest inventor of our age, was a poor ten-year-old lad at Port Huron. Many others comparatively obscure were to link their names with a lustrous period to which future generations will turn for inspiration, and study for example.

MICHIGAN FORTY YEARS SINCE.

But the changes made in this interval are still more strikingly shown in the growth of our own State and the development of its educational system. In 1857, Michigan lacked one year of reaching her majority. Her admission into the Union dated back but twenty years. The Michigan Agricultural College is just two-thirds as old as Michigan herself. The State capital, at the date we are considering, had been at Lansing but nine years. The State Normal School had just begun to send out its first pupils. The first diplomas granted by the University had gathered the dust of not quite a dozen years. The great chasm between the primary and grammar schools on the one hand, and the University on the other, stood open to be filled by the graded and high school system in the towns and cities. Michigan had then but one-fourth of her present population, limited chiefly to the four or five southern tiers of counties. At the opening of this institution, there were only four representatives in the legislature from the entire territory north of a line drawn through Saginaw, Midland and Newaygo. Ten years after, it was my good fortune to have for colleague in the Michigan legislature, and on the committee of education, a distinguished member of the faculty of this College,—I refer to Professor Kedzie,—one whose earnest work and scientific research have made his name a household word in our own and other lands; in the house also was another distinguished participant in this day's proceedings, the Hon. William Ball, president of the State Agricultural Society, always an untiring and efficient friend of the College. In that legislature, as they will recall, the Traverse City member had a constituency of thirteen counties, so sparsely settled was that part of the State only thirty years ago.

In 1857, the railways in Michigan were very few. They only comprised the trunk lines of the Michigan Central, the Michigan Southern, and the still uncompleted Detroit & Milwaukee. There was much sharp criticism that the Agricultural College and its experimental farm had followed the State capital into the northern wilderness, where there was no railway access. It was a common remark that on this ground alone, the legislature in selecting the site of the institution had perpetrated a great folly, a charge that time made obsolete, long ago.

REFORM IN COLLEGE EDUCATION.

But all other changes put together are of less significance than the advance made in the methods and purpose of collegiate education. Fo ty years since, no college in the United States had been emancipated fr m the idea that it must have a single unvarying curriculum and that no

one was liberally educated unless he had entered and passed through that straight and narrow way by which a chosen few had journeyed to the honors of graduation; and yet when a college student had reached all these honors, he was really less disciplined in useful training, and less fully equipped with needed information than the present graduates of our high schools. A college course at Harvard or Yale, and in all institutions which, like the University of Michigan, then followed in their wake, was of one stereotyped pattern transmitted from mediæval times, much better fitted for monks and ecclesiastics than for the widening and exacting requirements of practical, modern life. Just about the period when this College was opened, the American people began to realize the need of directing educational agencies to more useful ends and of enlarging the scope of college instruction. Michigan, by the introduction of elective courses in her University, and the establishment of this institution, and afterward of the Michigan School of Mines, both of which are especially designed to qualify its students with technical as well as general knowledge, may justly be claimed as a pioneer in a great movement of educational reform which has extended to other states and afforded models for the high schools and colleges of the whole land.

ECONOMIC AND INDUSTRIAL QUESTIONS AT THE FRONT.

Coincident with this revolution in the system of education and in a measure the result of it, has been the creation of a wider and deeper interest in economic questions and in all those branches of practical study, which prepare the citizen for a useful career, and fit him for efficient effort in pursuits which, in promoting the industrial and economic welfare of communities, of necessity elevate them to a higher social, political and moral plane. Twenty-eight years since, the authorities of this College honored me with an invitation to make the commencement address, and in an endeavor to discharge that duty, it was my aim to show that as justice is the end and purpose of that political organization we call the state; as that of a normal school is the art of school instruction; as that of the university is general mental training and culture; so the ultimate special purpose of the Agricultural College is wealth, by which was meant that its particular sphere is the cultivation of the industrial or wealth-producing arts. It was my design to prove from history that the development of these arts is the basis of all intellectual progress, of the advancement and preservation of liberty, and that it is the chief impulse to the onward march of civilization. I recall, as one of the specially gratifying remembrances of the occasion, that Professor Kedzie, at the close, advanced and took my hand, saying: "When you began by stating the proposition that wealth and the production of wealth form the discriminating work of this institution, I was disposed to dissent, but in the light of your application, it challenges my heartiest concurrence."

AN INDUSTRIAL AGE DEMANDS INDUSTRIAL EDUCATION.

No forty years in the world's history so forcibly as the last forty, illustrate the remark of Mr. Lloyd Brice in the North American Review for the current month that "industrial evolution is civilization;" and to this College, in providing for industrial education is to be given the credit of

recognizing and of conspicuously bearing witness to a great truth which the world is coming, though slowly, to accept. Whatever people may think of a tariff, or the want of a tariff, of one theory of the currency or of another theory of the currency, as factors in developing a nation's industries, it is certain that technical school instruction is needed for that industrial evolution which marks our age. In Germany, the remarkable growth of manufacturing industries is attributed chiefly to the skilled labor taught in industrial schools. A leading Trade Review of that country says in a recent article:

"It has been pointed out by Lord Roseberry to Englishmen and by several advanced thinkers in the United States to Americans, that one of the causes of Germany's success in industrial welfare is the superiority of her system of technical education. Her technical schools will be found in and about every industrial center, and wherever they are found it will be admitted that they have so largely increased the efficiency of the work people that equal results could not have been obtained without them. The technical schools are supported by the State, and they provide the means for all who wish to become expert workmen."

We thus see that the world is coming to recognize the value of educated labor and of scientific appliances to the mechanical arts as well as to agriculture.

MARVELOUS INCREASE OF WEALTH.

This recognition, however, has been of slow growth. The new era of industrial and wealth producing energy and the consequent elevation of labor, and of the arts which labor subjects to its service, belong to the last half of the present century. No statistician or economist, in noting the wonderful increase of wealth, or the expansion of industry which mark our time, goes back beyond the year 1850. Only the last four reports of the decennial census of our own country are used as the waymarks of this rapid advance which seems destined to soon reach a plane of civilization, of which our fathers only dreamed as possible, in a very distant future. Mr. Mulhall, perhaps the world's greatest living statistician, shows in a paper just given to the public that the average wealth of each person in the middle States of the Union, has almost quadrupled in the last forty years, whereas it has been considered by economical experts that a nation must be phenomenally prosperous, in order to merely double its wealth in that period. He also shows as the result of his comparison of the census tables, that the scale of wages for manufacturing operatives in those States, has been raised 115 per cent; and Michigan would undoubtedly exhibit a similar increase. Labor has acquired an immense increment to its share in the profits of industrial investments, during the period under review.

AGRICULTURE THE LEADING INDUSTRY.

But this college, in its very name, assumes to provide the opportunity for acquiring a thorough agricultural education, and so to be an efficient means of promoting agricultural industry. It accepts agriculture as the mother of all the arts, and art is a word derived from a root which in the primitive language of our race, signifies, "to plow." The old Romans, an intensely practical people, saw that agriculture was the basis of all national prosperity, and when an ancient Italian city was founded, the

limits were marked out by a plow, as Mommsen tells us, to indicate the debt which every industry owes to this primal industry. When that nation took Carthage, the Senate ordered the immediate translation of an agricultural work found in the captured city, for the use of the farmers of Italy. The most ancient civilizations of the world were planted on the rich alluvium of the Nile, the Euphrates, the Indus, the Yangtse-Kiang and other great rivers where this mother of arts could be nurtured and made to provide for the essential and unceasing wants of humanity. The fat soil of Thessaly nourished the first civilization of Greece; the germ of the Roman Republic and of the world-wide empire that succeeded, was first set in the then rich lands surrounding the Tiber. That agriculture still remains the mother of industry goes without saying. She needs none of our praise; she speaks for herself. Her long and unvarying record of indispensable beneficence is written in the whole history of man. Without her, all other industries would languish and die. They must all be covered and brooded under her maternal wing or else perish. In caring for her progeny, the other arts, we cannot afford to neglect her. And yet when an accusation is brought for her neglect, must not the present age, so noted for its enterprise in expanding other industries, plead guilty, at least on many counts of the indictment?

FARMING INTEREST NOW DECLINING.

Some countries may prove to be exceptions, but in our own and most European nations, there is a general complaint that agricultural industry, for some time past, has been on a decline. Great as have been the improvements in agricultural machinery and implements, extensive as have been the new appliances of science to this industry, it has not kept pace with manufactures as a source of remunerative wealth. England finds that her wheat area, within the last half century, has been reduced from 4,000,000 to 2,000,000 acres, and Mr. Mulhall's figures show us that our middle States, consisting of New York New Jersey, Pennsylvania, Delaware and Maryland, with the District of Columbia, having an estimated population of over 16,000,000 do not raise enough food for the State of Pennsylvania with an estimated population of a trifle over 6,000,000. Of course, it may be replied that agriculture has sought more congenial fields, that it has occupied the newer regions of our own west, or of South America, Australia or other remote lands, but this fact does not wholly account for the startling revelation that our farming industry has undergone a most serious depression which threatens to be still more serious, unless efficient measures are taken to arrest it. A writer in an English magazine quotes a suggestive statement from the last report of the consulting chemist, Mr. F. J. Lloyd, to the British Dairy Farmers' Association, who says:

"I venture to think that when the history of agriculture in the nineteenth century shall be written, one of the most remarkable facts to be recorded, will be this: While every other industry made strides of progress by the aid of science, and every agricultural society put scientific advice and aid at the disposal of its members, the farmers of England utterly ignored their aid and allowed the very science which was ready to help them, to be utilized by their competitors, until all the best markets for their produce had been lost and they had become bankrupt."

AGRICULTURAL EDUCATION THE REMEDY.

The writer who quotes these words of admonition and warning to the English farmers, insists that they must acquire an equally good industrial education with that of their foreign rivals or be "outstripped in the industrial race," and that this education must be given in the school. In France the primary and higher school in every rural district is obliged to provide a course of agricultural teaching, and besides, there are in that Republic 4,000 example plots for agricultural experiments maintained at an annual expense of about $60 each, chiefly from local contributions of the land and labor required, the government furnishing the seeds and manures. These are some of the lessons furnished from abroad, proving that one very important remedy at least for the decline of the farming interest is to be found in that practical, thorough, scientific agricultural education, which is one of the leading aims of the Michigan Agricultural College.

INFLUENCE OF THE COLLEGE.

That this institution is now, and has been, a most efficient aid to the farming interest in our State and in the entire country is clear to every one conversant with its record. There is not an agricultural industry in Michigan, or in the United States, that has not felt the beneficent touch of its influence, either through its class instruction, its original investigations, its scientific experiments, its periodical reports and circulars issued by its professors presenting the results of their inquiries, the lectures given by the members of its faculty to farmers' institutes and other agricultural meetings, the sending forth of the alumni into all parts of the land as living epistles of the information it imparts, and perhaps more than all, in the creation of a public opinion that the world's greatest industry merits the application of science and the use of scientific methods as well as those minor industries which, important as they are, have really a less significant part in the production of the world's wealth and in the supply of the indispensable requirements of human necessity and comfort. Observation and experience combine to show that the influence of the higher schools of instruction, is not all measured by the immediate knowledge conveyed to students in the class room, but in the spirit of intelligent inquiry they create and in the spread of accurate information and correct theories in the community at large. Agricultural colleges thus become fountains of irrigation, which in the diffusion of reliable knowledge, give life and vigor to the industry which they are designed to promote; and can we doubt that the future farmers of Michigan will acknowledge that the most valuable and efficient system for irrigating the waiting fields and the uncultured plains and valleys of our State, that could be devised, is afforded by the institution which their considerate and self-sacrificing fathers, out of their frugality and not out of their abundance, founded on this spot and threw open to students forty years since? It was but a small beginning, derided by some, considered chimerical by many, and not even possessing the fullest confidence of all who were willing to make the venture, even though it might be a failure.

FORMER OBJECTIONS TO THE COLLEGE.

A prominent source of opposition to the college at that day was the prevalent prejudice against what was sneeringly termed scientific farming. To many there appeared to be something dudish in college agriculture. School farming was regarded as something foppish, and it is true that a fop nowhere seems more out of place than when he attempts to guide the operations of an industry which, above all others, demands the exercise of a practical judgment and a tendency to look upon the practical side of things. Educated dandies and visionary theorists are useless everywhere, certainly so in a calling which constantly deals with the most hidden processes of nature; but the people of Michigan have long since learned that the most practical lessons in agriculture, the most profitable, the most money-making in every branch of that industry, have come from the professors and graduates of this institution. As agriculture is the mother of arts, so it is the most comprehensive of sciences; it embraces a great variety of special industries; it opens numberless avenues for remunerative exertion; it has numerous roads to the attainment of wealth; there is scarcely a single truth of science or acquisition of knowledge which may not be appropriated, utilized and effectively wielded for its improvement and success; Michigan people have come to realize this; and if they have discarded the sneer at the educated and scientific farmer, it is in no small measure due to this college which, during these past forty years, has been gradually proving its utility by obvious results and with such irresistable force of demonstration as to remove one of the most common and apparently one of the most effective obections urged against its first adoption as a feature of our educational system.

Another objection to the college, one which has even had support from some who confess the value of its aims, has arisen from a feeling that it ought to have been consolidated with the university. This was once a favorite theory with many prominent educators and influential citizens; but experience has shown the futility of incorporating into one, two institutions so unlike in purpose and in their sphere of operation. It has been seen to be inconvenient for the university to so broaden its curriculum as to embrace studies required in a preparation for pursuits chiefly industrial. Besides, it is obvious that the university can never suffice for the growing demands of higher education in the State, so that in time there must be a multiplication of universities or an additional supply of institutions designed and equipped for an individualized province in the work of education. We must bear in mind that synthesis is not the only method of development; analysis is equally required by the law of universal progress; all organized being advances toward perfection by being specialized; the most complete unity is attained through diversity. The Agricultural College and the university will be but parts of Michigan's "stupendous whole," when time shall have rounded out and perfected, as it is now fast doing, her higher educational system and have crowned it with final completeness.

Another obstacle encountered by the early advocates of this college was the attitude of the denominational institutions of the State, then

quite different from what it is now. At that time, such colleges as Albion, Kalamazoo, Olivet and Hillsdale had not abandoned the idea of securing public aid, in some indirect way, and were therefore watchful of any undertaking which was likely to make their efforts more difficult.

SOME EARLY REMINISCENCES.

These several antagonisms have, however, been steadily overcome. It certainly required wise foresight and more courage for the legislature of 1855 to decide that the time had come to take up the duty imposed by the constitution of 1850, which declared that "the legislature shall encourage the promotion of intellectual, scientific and agricultural improvement, and shall as soon as practicable, provide for the establishment of an agricultural school." It was fortunate that Michigan had then in the chief executive chair a man possessing the broad conception, the enlightened statesmanship and strong purpose of Kinsley S. Bingham. He stands conspicuous in the honored list of those governors of our State who were farmers; and the history of this institution cannot be rightly written without awarding him a high place among its founders and the guardians of its infancy. While the institution was supervised by the State Board of Education, on which the voters of Michigan had the temerity to place myself as much the youngest member, we had Governor Bingham as our wisest and most efficient adviser.

The board chose for the first president of the college, the Hon. Joseph R. Williams, who had acquired a notice which may be said to have become national, for his forcible and eloquent appeals for the application of science to agriculture. During his presidency, much was done toward giving definite shape to an experiment concerning which conflicting views were held as to its real purpose, whether the college should be chiefly a manual labor school, or a place devoted to studies which exclusively relate to agriculture, or a general seminary of all higher learning. These conflicting views have been prevalent from the beginning, but were then much less fully harmonized than now. In securing this harmony, President Williams and his colleagues in the faculty had a delicate and difficult task, and the sequel has shown how well they acquitted themselves in its performance.

The Board of Education had direction of the college for four years, and by its own request, the legislature placed it in charge of the State Board of Agriculture under whose management it has since successfully continued. The former board was then, as it is at present, of rectangular shape, but it is to be hoped that its present members in their management of the Normal School escape from some of the embarrassments experienced by their predecessors; as I recall that in the spring of 1857 a Normal School question occasioned a dead-lock for a whole week, two very firm and unyielding sides of the rectangle standing out with solid resistance to the other two sides, but as we were serving without pay, save for necessary expenses, the public treasury did not greatly suffer; but the incident fully proved, as did the frequent experience of our Michigan Supreme Court in those days with its four members, that a quadrilateral, however useful it may be for defensive operations in military campaigns, is not the most suitable device in the formation of courts or administrative boards.

My associates on the board at first were the venerable Judge John R. Kellogg, of Allegan, and Hiram L. Miller, of Saginaw, both men of large experience and sound judgment, and as an ex-officio member, the then Superintendent of Public Instruction, Hon. Ira Mayhew; afterward my colleagues were Hon. Witter J. Baxter, of Jonesville, a man of energy and practical wisdom, Hon. Edwin Willits, of Monroe, who recently served with signal acceptance as president of this institution, also in Congress, and as Assistant Secretary of Agriculture, at Washington; and Hon. John M. Gregory, the Superintendent of Public Instruction who succeeded Mr. Mayhew, and who afterward presided with distinction over the Illinois Industrial University, and was United States Civil Service Commissioner. In the faculty were Professors Abbot and Fisk, the former of whom suceeded President Williams in charge of the institution, and discharged his duties with notable success, while the latter has acquired deserved distinction as president of Albion College. Professors Weeks and Holmes were the other members of the faculty, both able and popular instructors and efficient promoters of the welfare of the institution. Not belonging to that body of pioneer instructors, but among those who soon aferward succeeded them was "the wizard," who, thirty-four years ago fascinated the students of the infant college by the wondrous magic of the chemical laboratory, and now, after more than a third of a century has passed, he is "the wizard" still, whose connection with this institution will ever be an integral part of its history.

MICHIGAN'S DEBT TO EDUCATORS.

Tappan, Welch, Frieze, Boise, Gregory, Winchell, Stone, Mayhew, Fairfield, "Prof." Williams, Hosford, and among the younger men, Watson, Estabrook, Sill, Tyler, and others were known beyond the boundaries of their own State; but the educators of that period did not monopolize the fame which our commonwealth was to gain from its contributions to intellectual work or to the adaptation of literature and science to the uses of every day life. Proud as we have reason to be of the men and of the achievements that at an earlier day served to bring Michigan to the world's front for her harmonious and complete educational system, there has since been a constant movement forward and upward, showing that the later generation is faithfully and wisely building on the fundation they laid. This is an age of scientific inquiry; it is an age when men are passing out from the slavary of tradition; it is an age when knowledge is sought for practical uses, and when higher education is claiming its place in the workshop, in the counting room, on the farm, and in the kitchen; it is an age when eduction is needed to "form the common mind," not confined to the exclusive few; and this institution pre-eminently stands for the age to which we belong; and as one of the best representatives of the high water mark which the tide of public education has reached, and as one of the most approved types which this education is able to present in the closing years of the nineteenth century. And it is especially gratifying that this superior type of education, in this college as well as in the university, is now provided for women as well as for men.

THE COLLEGE TYPIFIES THE NEW ERA.

But above all, and greater than all the actual science which this college teaches, is the spirit of investigation which pervades it, and the welcome it gives to truth in every department of knowledge. The range of its studies cultivates a tendency to see things as they are. A striking passage in the Novum Organum of the great Bacon, the founder of modern science, might be taken as the motto of this college. In urging the claims of his new inductive system he says: "We deeply prize light because it enables us to walk, to perform our daily tasks, to read, and to recognize one another; and still light itself is a grander and a fairer thing than all its possible uses; so the contemplation of things as they are, without superstition and imposture, without error or confusion, is of itself of more worth than all we discover by it." By this forcible illustration he shows that valuable as are all the acquirements of knowledge, the proper spirit and the right method of attaining it are still more so. Therefore it is that the real value of this institution cannot be measured without taking into view the impulse it has given to the effort to put the teachings of science and the deductions from experiment in the place of mere tradition.

This college presents a model for institutions which must be greatly multiplied in the next and succeeding centuries. It symbolizes the era of intellectual freedom; it is the product of that practical philosophy which comes from modern ideas. Whatsoever may be our regard for the classic ideals embodied in ancient literature and art, they cannot hereafter be made the chief objects of collegiate study. They may have been excellent in their time, but the old must give way to the new. In the halls of this college, in its museum and on its grounds, the creations of art derived from ancient mythology, the mythical heroes and deities of a remote and fanciful past, must have a subordinate place. On the highest pedestals will stand the statues not of Jupiters and Apollos, but of the great inaugurators of modern thought, the living; real men who have led modern civilization, such as Bacon, Descartes, Newton and Franklin; and scarcely less lower, those of Liebig, Darwin, Huxley, and our own Edison. To be imbued with the spirit of earnest, truthful inquiry shown by such men, is a long step toward a right education, an education which enables us to discover and guide agencies which are rendering the world richer in its supply of everything needed for its industrial, intellectual and moral welfare. It is because of its success in providing for an imperative educational demand of the age, that the Michigan Agricultural College has long since passed the crisis of doubtful experiment. It has outlived the multiform opposition of the past, is constantly winning new testimonials of popular favor in the present, and is certain to achieve still higher triumphs in the future. It is a monument every way worthy of Michigan, and will forever bear witness to the enterprise, public spirit and wisdom of her people. Upon this institution which they established and have hitherto not failed to maintain, we may be assured that they will ever continue to bestow their confidence and their steadily increasing support.

THE RELATION OF THE STATE AGRICULTURAL SOCIETY TO THE COLLEGE.

ADDRESS OF HON. WILLIAM BALL, PRESIDENT OF THE STATE AGRICULTURAL SOCIETY.

The subject assigned me for a ten minutes' talk is in the main historical and not calculated to enthuse the hearer to any extent.

The State Agricultural Society was organized nearly fifty years ago under an act of the legislature of 1849, holding its first exhibition that year. The organization grew out of the necessities of agriculture.

Thinking men saw the necessity of some concerted action in agricultural pursuits in the State, and at that time no better system could be devised to create an interest in stock breeding, general farming, and kindred arts than by the formation of such a society. That it did, and has done a noble work in the direction intended by its originators is abundantly proved by the success of its forty-seven exhibitions held in various parts of the State. Early in its career the founders of the society, and its officers subsequently elected, saw the necessity of something in advance of what the Agricultural Society could furnish if the ends sought were to be realized, and the agriculture of the State placed in a position which its importance demanded.

Accordingly at the second annual meeting of the society held in the city of Jackson (then a village), Mr. Bela Hubbard offered the following resolution:

"That our legislature be requested to take such legislative action as shall appear necessary or expedient for the establishment of a State central agricultural office, with which shall be connected a museum of agricultural products and implements, and an agricultural library, and as soon as practicable, an agricultural college and a model farm."

The resolution was supported by an able argument presented by the maker of the resolution, but was subsequently laid upon the table. The good seed had been sown, and in the year 1855 the executive committee took such steps as were necessary to importune the legislature to pass an act establishing an agricultural school and model and experimental farm. Its purpose was followed by the passage of a bill to that effect and became a law February 12, 1855. Preceding the action of the executive committee in 1855, it had in 1852, at its annual meeting, adopted a resolution asking the legislature of 1853 to establish an agricultural school in connection with an experimental farm. The memorial, like many other meritorious measures of later days, failed to materialize; and not until 1855 did the Agricultural Society secure the aid it so much desired in the way of agricultural education and experiments.

I have been somewhat prolix on this part of the paper in order to show the position of the State Agricultural Society relative to the needs of agriculture, and further to show the active part it took in establishing an institution in which all good citizens of the State take so much just pride. Having been connected with the State society as an official for

nearly twenty years, I shall be pardoned if I seem to attach too much importance to what I consider one of the most important questions settled which ever affected the vital interest of the State of Michigan. The loyalty of the society to the College is not less now than in its earlier history. Instead of being its progenitor it acts in unison with it as a friend and brother. The great work of educating the farmer, the citizen and the student has been transferred to this grand institution where it properly belongs. No grander monument need be erected to the wisdom and foresight of the State Agricultural Society than is here located, in this beautiful spot adorned by nature, and by the wisdom of the architects who have made the wilderness become the dwelling place of science, art, adornment and usefulness.

If in the progress of events the State Agricultural Society shall have reached the end of its career, and is no longer needed as a stimulus to agricultural operations, stock breeding, etc. (which God grant may never happen), it will have a place in history as one of the promoters, and the main one, of this greatest and first institution of its kind in the United States. In believing the State Agricultural Society as directly connected in its relations to the College, let me ask that in your days of prosperity, you may as cheerfully give of your ability to strengthen and aid the State society as it gave its assistance in helping to secure the grand benefits, which as a College, it and you enjoy.

With the knowledge that I may be trespassing upon your time, perhaps a little history, the trials and tribulations through which the College passed before reaching its present commanding position may not be amiss. Previous to the passage of the law forming the College, scientific agriculture in its elemental nature was taught in the Normal School in Ypsilanti. In March, 1853, during the discussion of the needs of an agricultural college, and before any legislation had been enacted with reference to it, the regents of the University at Ann Arbor issued a circular announcing that a free course of lectures would be given in the University of Michigan upon agricultural science, commencing on the 27th day of April and closing on the 28th day of June, the subjects being theoretical and practical agriculture. It has always appeared to me that by "taking time by the forelock," as the saying goes, the regents thought that such a course would be an argument that a separate institution to teach agriculture would not be necessary, and the University would be strengthened in having control of agricultural training as well as the other branches taught; and who will blame them. So well had the plans been laid, so imbued had some of the leading newspapers of the State become with the idea that no separate institution of learning was needed, that years elapsed before the friends of the College who believed it should be independent in its work and management, felt secure in its permanency so far as location was concerned.

To show how the State Agricultural Society felt upon the question of independence from other institutions of learning, I quote from the report of the State Board of Agriculture in 1863, page 21, and others following, and also to call your attention to the acknowledgments of the Board of Agriculture to the State Agricultural Society for its earnest and effective work in its behalf. In presenting what I have, it has been with the idea that a fair understanding of the mutual relations of the Agricultural Society with the College would not detract from the prestige

of the College, but on the contrary, cement a friendship between two institutions, both working for a common end, but in ways applicable to each in its special field of labor.

THE RELATIONS OF THE GRANGE TO THE AGRICULTURAL COLLEGE.

HON. GEO. B. HORTON, MASTER OF STATE GRANGE

Mr. President, Ladies and Gentlemen:

I fully appreciate the honor conferred upon a great farmers' organization of our State by inviting me, as its official head, to be present on this, the fortieth anniversary of the establishment of the Agricultural College. It is often said, this is a day and age of progress, and of wonderful achievements, and no object lesson can prove this more conclusively than the present high standing of our educational institutions, as the result of constant demands upon them by the people for broadening of methods and the adoption of new and advanced ideas in their work.

Forty years is comparatively a short space of time, and is but about the working, active days of the man who lives the alloted four score and ten years, yet during and within these years all that we may now see before and around about us pertaining to this institution has been built and equipped, on grounds where up to that time was an unbroken forest.

I doubt not there are persons present who assisted in blazing the lines through the woods for the now improved and well graded highways over which are hauled daily loads of produce from the improved and cultivated fields of the farms so recently reclaimed. Upon these farms we now see commodious houses and barns well calculated for the convenience and comfort of family and stock that inhabit them. Then the deep unbroken forest, now the stumpless, tile-drained fields, with homes substantial and beautiful. All these improvements are but an index to the lives and purposes of an industrious and intelligent people.

With these people it was but natural that education should be made the foundation of the State's advancement, and the guide to its future destiny. Thus liberal grants of the public domain was early made for the establishment and permanent support of a general free school system, and to furnish advanced opportunities for study along the lines of preparation for active duty in the professions and various lines of business. In this general plan the great and all important interest of agriculture was not left out, but instead, received liberal recognition.

When we consider that the success of agriculture measures the success of all other interests and that as many people are engaged in agricultural pursuits as in all others combined, we see the essential importance attached to the work of this College, and which institution with its relative departments should be the greatest, the best provided for, and best patronized of any of the educational institutions of our commonwealth.

If also, as oft asserted, that the country homes must act as a filter to purify the corrupting influences of villages and cities, and if the farmers of this land must act as the wise, conservative judge in the final adjustment and settlement of great public questions, to the end that justice and right will prevail, then the work of this and like institutions is of greatest importance, and thus not only the scientific and successful cultivation of fields are involved, but a broad and thorough training of the boys and girls of the farm is demanded, that they may be competent to act well their part when they assume the duties of active citizens and parts of society.

As conditions change, so should these parts of college work, which are intended to exercise an influencing care over the methods of the people in whose interests the College is established, or soon the people and the college are estranged, with the institution of learning following instead of leading, a condition the reverse of which should be. The people cannot and will not stand still. They read, think and see, and from these they conclude and act. To the end that conclusions and actions on the part of the farm people of our State may be along uniform and sympathetic lines, those who have charge of our Agricultural College have a duty to perform. These words are not spoken to criticise, but to warn. It can be plainly seen from the trend of events that selfishness is inclined to govern men in support of the particular interest in which they are engaged, and thus a supremacy of interest is inclined to be the goal of ambition, which condition should call us as farmers to look well for our own.

The Agricultural College should not only teach advanced principles in gardening, orcharding, crop and stock raising, but it must, through its extra opportunities and high position, stand by the general interests of agriculture and its devotees, and support and encourage them from the material and social standpoint. In a large degree the rise or decline of agriculture and its people in all their varied interests and welfare should be, and are, in the hands of this and the other agricultural colleges of our country. Standing as they are at the head of this great interest as the men at the wheel, the rocks and shoals that wreck and bring discouragement and despair should be pointed out and shunned. I repeat that it is not enough to understand the art of plowing, sowing, cultivating and harvesting, for as essential as are all these the successful result of them all is in encouraging and maintaining a high social and influential standing, commensurate with the importance of agriculture when compared with other interests. These and none other are the successful results of labor and life upon the farm.

In this great work the farmer himself has also a duty to perform. He must assume an anxious, willing and supporting attitude toward the College. He must be in friendship and close communion with its work, and he must also be ready and willing to defend it against attacks and unfriendly criticisms, such as would injure or are intended to destroy.

One of the greatest and most efficient aids to the College in its work of the future is organization among the farmers, where the interests of agriculture and its people may be considered and kept before them, and sentiment crystalized in favor of the College to the end of liberal support.

Then again, I say, the College and the people must go hand in hand, and also add that the farm community that fails to put itself in position through organization for concentrated influence and action falls far short of its duty and may be justly criticised as not having a proper interest in the welfare of their calling and the institutions that seek to do good to the great interest of which they form a part. I am not here to press upon the farmers of the State the kind of organizations they should employ, but on general principles, I say organize, and choose the organization that you conclude will serve you best, and then let there be a union of action between the organizations for the accomplishment of results beneficial to all.

I repeat that through organization and concert of action, and in no other way, can the interests of agriculture and its institutions be successfully maintained.

I am proud to stand before you as a representative of a great and influential farmers' organization that has always supported the Agricultural College in all its efforts and work. In this connection it is gratifying to note that the College has always recognized the order of the Patrons of Husbandry as its friend and co-worker. May this mutual sympathy be maintained so long as the two institutions shall exist. It is gratifying to note that several important features of college work have been brought about through the suggestions and solicitations of the Grange; notably, the Farm Home Reading Circle, admission of girls to full privileges with boys, and the establishing of an operative dairy department. In behalf of our organization, I thank the College authorities for this privilege of being represented on this very important event. May this time mark the beginning of a new era of great usefulness and influence is our wish, and in support of which I pledge you our hearty assistance.

ADDRESS BY J. T. DANIELS, PRESIDENT STATE ASSOCIATION OF FARMERS' CLUBS.

Mr. Chairman, Ladies and Gentlemen:

We have met at this time to commemorate, with appropriate exercises, the 40th anniversary of the opening of Michigan's State Agricultural College, and it is most proper that these exercises show, by means of results attained, the wisdom of establishing this institution of learning.

This pioneer college, in its progress, has opened the way for the establishment of many others, and here, as in many other instances, has the well known enterprise of the "Wolverines" led.

When we consider the importance of agriculture to all of the people, of every nation—remembering that food is vitally essential to the continuance of human life, and that agriculture is essential to the proper supply of food products—then may we understand how beneficial to all of the people are those agencies, by which and through which the science of agriculture is advanced.

It surely is unnecessary to support by argument the statement that agriculture is the most ancient, the most universally followed and the most necessary of all of the occupations followed by man.

This College was established, we understand, for the purpose of bringing science to the aid of agriculture, and the question very naturally here arises: Is it accomplishing, and to what extent is it accomplishing, the purposes for which it was established?

"The people" are, today, asking for practical results, in all matters which concern the public. The "depressed condition" of which we have all heard, and of which many of us have felt, gives adequate reason for this demand.

But leaving the consideration of the subject, along these lines, to those better qualified to correctly determine, let us consider, for a few moments, the relations which should exist, and seek to ascertain if these relations do exist, between the farmers of Michigan and their State Agricultural College. No extended words are needed, no arguments need be produced; the simple statement is sufficient, the relations which should exist are those of mutual confidence and sincere helpfulness.

But I desire to speak, more particularly, of these relations, as existing between the College and the more than 250 farmers' clubs of the State, with their many thousands of members, and as represented through their central organization—the Michigan State Association of Farmers' Clubs.

The nearly 20,000 men and women comprising the membership of these farmers' clubs are loyal to education—to that education which results in "the full and high development of all of the faculties and powers of our being"—and as thus defined, most truly and most emphatically ought the farmer, with a broad field for observation and great opportunities for research, to be a most loyal supporter of "education."

From certain quarters has come the intimation that the farmers of Michigan, as represented through the farmers' clubs of the State, are opposing "higher education." This intimation is unjust because it is untrue. The farmers are not opposing "higher education," if rightly defined. But this they do oppose—and well and wise is it for them to oppose—every form of unwise or extravagant use of the public funds; and present conditions surrounding rural homes make this request for the prudent use of all public funds a most just and reasonable request.

I have said the farmers of Michigan are loyal to education, and they are justly proud of our beneficent and magnificent State educational system, whereby every citizen may acquire, in our public schools, that education which shall fit him for "good citizenship," and while the great importance of sustaining our primary schools is shown by the fact that about ninety-five per cent of our people acquire therein their only education—so far as aid from our public schools is concerned—yet this fact does not lessen the necessity, and therefore the wisdom of upholding and advancing our higher institutions of learning.

And this the farmers will do, provided they can feel that practical results are being secured through the operations of good business conduct.

It may be proper to suggest that the farmers of the State are not as familiar with the workings of their State Agricultural College as they should be. It will bear and invites candid investigation, and will be strengthened by just, candid and friendly criticism.

In conclusion, I feel that I may safely assert that in so far as our State Agricultural College holds to the purposes for which it was established, and produces practical results along those lines, the farmers' clubs of Michigan will give to it consistent, earnest, practical and loyal support.

WHAT THE COLLEGE HAS DONE FOR PRACTICAL AGRICULTURE.

JAMES SATTERLEE, A GRADUATE OF THE COLLEGE, CLASS '69.

Many people, without looking into the matter very deeply, are apt to think, and sometimes make the statement, that our College has not done as much for the advancement of practical agriculture in Michigan as she might or should have done. This may possibly be true, but when we look at the difficulties she has had to contend with we can readily see that more has been accomplished than might reasonably have been expected.

The literature of practical agriculture, with its text-books and its records of experiments, have had to be re-written during the life of our College. The natural prejudice against book farming, so called, has had to be met and overcome. With few exceptions teachers have sneered at the value of an education along the lines of farm practice. Although the spirit of the age is changing, many teachers still hold up the literary education as the ideal education, and it is made as attractive as possible. The trend of our district school work, high school work, and literary college work has been toward the development of literary ability, and in lauding the power that comes from ability in that direction. While our College has not been deficient in the spirit of literary excellence, she has done much more to help her graduates to grapple with the changing problems of practical life on the farm.

Our College has impressed upon her students the dignity and value of manual labor. The value of skill in the use of eye and hand. The value of improved methods in the cultivation of the soil. Above all, she has taught that cultivated brain power is the secret of successful agriculture. The world at large has adopted improved methods of farm work and farm management. Our College course has taught us the principles that underlie the improved practice; has taught us to use our heads as well as our hands.

Skilled and able men like Kedzie and Miles and Prentiss, like Beal and Bailey and Taft, Grange, Johnson and Smith, have impressed their personality upon the agricultural practice of our State. We can see it in the improved stock, improved varieties of grain, improved fruits, improved machinery, and in the cultured men and women engaged in the different lines of agricultural work.

These few things that I have mentioned are upon the surface and plain to all who care to look. Underneath these more practical and necessary things, we know that our College has also taught us the value of beautiful home surroundings, and the beauty of home building, in which the sacredness of family ties, the responsibilities of citizenship, and the obligation to be true and faithful to ourselves have all been emphasized. In the future these undercurrents of our college work will be strengthened by the graduates from the ladies' course. We of the older set, who entered here before the close of the first decade, or soon after, can feel and see the changes that have been wrought by our College and its men.

We may not quite understand the spirit of progress that has crept in, and the very pleasant experience we have had today of being served at our alumni banquet by our social equals, brings us to realize that new problems are being solved, and that in future we may expect complete harmony in the homes of all our graduates.

To those who have not been reached by our College course direct, but have only been brought into contact with the live, practical men who have advanced the standard of improved agriculture into every agricultural county of our State, through the Institute work, our College has been doing a grand work in stimulating better methods, truer home life, higher ideals. In future, I imagine, this part of our College work will hardly be less important along the lines of practical agriculture than will the College course proper.

I believe, however, that nothing can take the place of the training on the farm and on the campus here, and we hope that with all reform and all progress, that the importance of practical training of eye and hand in the lines of a still more advanced practical agriculture will not be lost sight of.

INFLUENCE OF THE COLLEGE ON SCIENTIFIC AGRICULTURE.

PROF. W. C. LATTA, CLASS '77, PROF. OF AGRICULTURE, PURDUE UNIVERSITY, IND.

That the methods of agriculture are becoming yearly more scientific and rational is evident to all who have closely watched the progress of this great industry in recent years. The rapidly extending mailing lists of the Experiment Stations, the numerous letters of inquiry addressed to station officers, the calls for scientific experts to address Farmers' Institutes, Farmers' Clubs, Granges, etc., the spirit of investigation manifest among the best farmers, and the increasingly scientific character of agricultural publications all show that the farmers are breaking away from the old traditions and are earnestly seeking "a more excellent way."

This change for the better is not an evolution from within, but the result of a mighty force acting upon and uplifting agriculture to its true estate. Leaven has been hid in the great lump of agricultural ignorance and superstition. That leaven is agricultural education. It has opened to the farmer the hitherto sealed book of nature's laws; given valid reasons for successful farm practice; explained the causes of failure; and put into the hands of the farmer a key to the solution of the many perplexing questions that confront him.

The Michigan Agricultural College has been a prime factor in diffusing and popularizing agricultural education; first, because it has been a pioneer in this field of education; second, because of the scientific character of her instruction; third, because of the wholesome trend of her course of study toward agricultural pursuits.

First to take up the work and foremost in rank, M. A. C. has not only led the van, but has, in a large degree, set the pace in agricultural education. Owing to her contributions of men to other institutions, M. A. C. may properly be styled the Mother of Agricultural Colleges. Her grad-

uates are identified with industrial institutions as professors of chemistry, botany, zoölogy, physics, entomology, agriculture, horticulture and veterinary science in probably three-fourths of the states and territories. Thus her influence has gone out to almost all parts of this great nation. Nor is this all. She has left her impress upon the agriculture of Japan and Australia.

M. A. C. has made her influence for a better agriculture felt in many ways; through her excellent courses of study; through her professors in their work as instructors, as members of scientific associations, as lecturers before Farmers' Clubs, Granges and Farmers' Institutes, and in their personal contact with practical farmers; through her graduates who have returned to the farm or engaged in teaching agriculture or sciences relating thereto; and last, but not least, through those students who, though they have not returned to the farm, are ever ready to champion the cause of scientific farming and thus help to create and enlighten public sentiment congenial to the continued growth of rational agriculture.

All hail to M. A. C.! "She hath wrought a good work." May she continue to labor with the same intelligence and zeal and with constantly increasing efficiency for the enlightenment and prosperity of the farmers of the State and nation. The encouraging record of the past forty years should inspire new hope for the future. With the united loyal support of the officers and faculty, alumni and students, the institution should go forward with accelerating pace and increasing power and influence for good in promoting the cause of rational and successful agriculture.

ALUMNI MEETING.

The triennial meeting of the alumni was held in the chapel, Thursday, June 17, at 10 o'clock a. m.

President of the association, M. D. Chatterton, with '61, gave a somewhat lengthy address, of which we give, very briefly, the principal points:

"The past and the present meet here today on a common ground. We who are older remember the past vividly, for we are deeply indebted to our instruction here, under Williams, Abbot, Holmes, and Tracy. But at these alumni meetings we should have some other purpose than talkiny over the old days and swapping college yarns. We all have the good of the College at heart. If we had legal rights and power in the management of the College these reunions would be great events for the College. I can see the immense difference between the College of '57 and '97. I see the immense difference in the plant, but I don't see as many students as I would like to see here.

A couple of years ago a committee of the College made a report of the condition of affairs. I do not think they hit upon the real cause of lack of students. In my opinion the College is handicapped by a law passed nearly forty years ago. I believe that: 1. The system of compulsory manual labor should be discontinued or greatly modified. Purely physical labor, as such, should be unknown except by consent. 2. The Board of Control should be named by the alumni.

In our farming, as well as in all industry, it takes much less manual labor than formerly. There must consequently be more time taken for thought. Brains are taking the place of muscle. The agricultural graduate must be a planner, manager. Vigorous manual labor is incompatible with active thought.

In many other colleges the board of control is chosen by the alumni, conspicuous among them being Yale. The alumni are ever loyal to this College and want to see her succeed. Therefore I recommend the repeal of the present law for the appointment of the board and have the power placed in the hands of either the alumni or the people, where it belongs."

The history was given by Prof. Warren Babcock, '90, who gave an account of the early struggles through which our College passed before being established upon its present firm basis. We today forget our individual trials in the glance of classmates and friends. There was great educational activity in Michigan at the time of the opening of this College. The Michigan Agricultural Society in 1849 began to battle for the establishment of an agricultural college. There was no model. Many opponents must be silenced. The friends of the movement early concluded that: 1. Individual or corporate enterprise could not be depended upon to install an institution of this character. 2. The College must not be an annex to any other institution. The early enthusiasts expected too much of the College, and disappointment was their portion; abandonment was at one time talked of. But the College lived and grew and has made a wonderful progress. We are proud of the record. The very difficulties have strengthened the College. The rough, austere surroundings have trained up men, genuine men.

Necrologist L. A. Bregger, '88, referred very briefly to those who have passed to the "great beyond" since our meeting three years ago. This list included the following: Albert N. Prentiss, '61; Frank S. Burton, '67; Wm. E. Frazer, '70; E. Burritt Fairfield, '71; Chas. L. Ingersoll, '74; Albert A. Crane, '75; George E. Breck, '78; J. S. Pardee, '78; Clark H. Eldridge, '83; Ernest G. Lodeman, '89; Orlando A. Turner, '90; George E. Hancorne, '90 ('86); Emilie Smith, '93; Robert S. Woodworth, '94; Frank N. Jaques, '96; President Willits, Col. Wm. B. McCreery.

Following this came an address by C. B. Collingwood.

The banquet was prepared by the Women's Department under the supervision of Prof. McDermott, and 300 guests were seated at the tables in the armory.

At the close of the repast, Prof. L. H. Bailey, '82, as toastmaster, called on M. D. Chatterton, with '61; R. A. Clark, '76; John Shelton, '82; Jason E. Hammond, '86; William C. Latta, '77, and H. W. Hart, '97, who responded to short toasts. After this the alumni called for speeches from C. W. Garfield, '70; A. C. Bird, '83; President Snyder, Dr. Beal, Prof. Wheeler, Dr. Bion Whelan, '77, and W. K. Clute, '96 ('86). Dr. Kedzie and Miss McDermott were also called for but had left the hall. At the banquet and interspersed with the toasts, excellent music was rendered by Bristol's orchestra.

BUSINESS MEETINGS.

The first business meeting of the Alumni Association was held in the chemical lecture room at 8:50 o'clock Thursday morning, with M. D. Chatterton presiding.

The secretary read the report of the committee on legislation, which set forth the belief of the committee that the alumni of the College should exercise an influence in its management. The report also gave particulars of work done by the committee to secure legislation requiring that as fast as new appointments on the board become necessary at least half the appointees be alumni of the College. While the desired legislation was not secured, the committee asserted finally that the "principle of co-operation between the alumni and the governing board is too important to abondon." The report was adopted.

The secretary read a communication from the State Board of Agriculture asking for the appointment of an advisory council of six members from the alumni to meet with the board from time to time. On motion of Frank Hodgman, the communication was accepted and a committee of three, consisting of Prof. F. S. Kedzie, Geo. A. Hawley and K. L. Butterfield, was appointed to consider the communication and report thereon at the afternoon meeting.

On motion of H. M. Wells, the secretary was authorized to appoint committees on resolutions and nominations. The secretary appointed as committee on resolutions Messrs. Bion Whelan, F. B. Mumford and F. R. Smith, and on nominations, Messrs. J. E. Hammond, L. A. Bregger, C. H. Alvord, William Petrie, and R. A. Clark.

The association adjourned to meet again at 5 o'clock p. m.

Second business meeting: The committee on nominations reported the following nominations: President, C. L. Bemis, '74; vice president, J. R. Shelton, '82; secretary, K. L. Butterfield, '91; treasurer, F. G. Clark, '90; orator, W. K. Clute, '96 ('86); alternate, J. W. Rittinger, '94; historian, L. H. Baker, '93; alternate, Mary Carpenter Mayo, '88; poet, C. B. Waldron, '87; alternate, J. Y. Clark, '85; necrologist, Lucy Clute Woodworth, '93; alternate, Jennie Towar Whitmore, '86.

On motion the secretary was authorized to cast the ballot of the association for the officers named.

The committee on resolutions reported the following resolutions, which were unanimously adopted:

Resolved, That we thank the State Board of Agriculture for their hospitality on this occasion;

That we heartily approve of the unselfish devotion of the State Board of Agriculture to the College and of their business-like management of its affairs, believing that they have constantly in view the best interests of the institution;

That we commend the policy which has recognized the Alumni Association by placing so many of its members on the State Board of Agriculture;

That we approve of the establishment of the Women's Course, believing it to be conducive to the present welfare and future prosperity of the institution;

That we approve of the establishment of short courses in agriculture, horticulture and dairying. These courses are within the reach of every young man or woman in the State and will aid greatly in bringing the College closer to the people; and,

Resolved, That any action tending to abolish the present student labor system will be detrimental to the highest good of our institution.

The committee appointed to consider the proposition of the board relative to an advisory council of the alumni, recommended the adoption of the recommendation, and also that the incoming president of the association appoint such a council, the members of which shall each serve until the next alumni reunion. The report was amended so that the president, secretary and Jason E. Hammond be the appointing power, and was then adopted.

The association adjourned sine die.

ADDRESS BY C. B. COLLINGWOOD, CLASS OF '85.

We are a peculiar people, and we have a right to be, for educationally we represent a new race. We do not meet as graduates of a great university, or as graduates of any professional school. We meet here today as graduates of the new and wealthy class of educational institutions, called land grant colleges; one of that class of institutions toward whose support our government has given millions of acres of land and millions of dollars, and whose avowed purpose is to promote the liberal and practical education of the industrial class.

I often wonder if we, as the first children of this pioneer movement, have reaped the full measure of its benefits or clearly discern its trend. For a thousand years before the Pilgrims landed at Plymouth, an education was inseparably connected with book learning, the study of languages was the first essential, and the deader the language the better the education. It was naturally of an unpractical nature. It was also closely confined to the rich or to the priest craft. The need of an education for the masses, for the every day citizen, was not dreamed of. But the settlement of this country was a great equalizer and a great broadener of the intellect. Men who had neither families nor education were placed in positions where their natural aptitude for leadership rapidly developed. They became the head and front of great communities, and their children, in turn, became of the first families. So rapidly was this shaking up and leveling down process carried on, so marked an effect did the first words of the Declaration of Independence, "All men are created equal," have upon the people, that the great industrial classes early demanded an education which would give them an equal opportunity with the rich and favored. But it was soon discovered, that while we had here and there a learned blacksmith who could expound in a dozen different languages while he did moderate work at the forge, most men did not make better mechanics because of their knowledge of Greek roots.

Contemporaneous with the development of this country, real science emerged from the rubbish of alchemy and phlogiston theories. When Lavosier demonstrated that matter was indestructible, and was measured by weight, it gave an immense impetus to honest scientific investigation. It was beginning to dawn on men that this world was ruled by fixed immutable laws and not by chance. Grand old Benjamin Franklin with his marvelous common sense did more, perhaps, than any one to bring the learning of the savants to the understanding of the common people.

As the years passed on, under the influence of the common schools, which became more and more free schools, the people clamored for an education which should include the hand as well as the head, and which should leave a man or a woman in the possession of full bodily senses, and yet not ashamed to work with his hands. It was gradually discovered that as general education advanced there must be some outlook for men beside in the professions; that lawyers, and doctors, and preachers, and teachers, were all very well in their way, but that we might have too much of a good thing.

The demand, I say, grew for a new education. It found expression in the manufacturing centers, in the organization of trades schools. It found expression in the agricultural states, in the development of agricultural schools. In Michigan, the constitution of 1850 provided for the establishment of an agricultural school, and provided further for the appropriation of certain salt spring lands for the support of the same. In February, 1855, the legislature passed an act establishing and locating an agricultural school. By the sale of salt spring lands $56,000 was secured, and in 1857, $40,000 was appropriated by the legislature with which these grounds were purchased and the school started. Down to 1860 the State had given about $133,000. The school had struggled for an existence, and its fate was uncertain. During this time a scheme was being agitated by which congress should appropriate a certain amount of its seemingly inexhaustible supply of land for the benefit of scientific education, and on July 2, 1862, the first Morrill Endowment Act was passed. By the terms of this act it was provided "that there should be granted to the several states for the purpose of establishing at least one college where the leadng object should be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislature of the states may respectively prescribe in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life." For this purpose, land, or land script, was issued to these several states in the proportion of 30,000 acres for each senator and representative. The smallest state received 90,000 acres. Michigan received about 300,000 acres. Altogether our nation gave for this form of education over ten million acres. A principality for popular education.

In February, 1863, Michigan accepted this princely gift, and the Agricultural College forgetting, in name at least, the other provisions of the bill, made haste to take possession of her patrimony. It was not, however, until 1869 that the Michigan Agricultural College realized anything from the sale of these lands, and then she received $58.96.

During these years from 1855 to 1869, the State of Michigan had appropriated about $250,000. From 1869 to 1884, the State appropriated $343,000, and there was received from the Morrill Endowment Act $238,000. Since 1884, there has been received from the State $293,000; from the federal government $681,000. Altogether in the forty-one years since 1855, there has been received for the support of this College from the State legislature, and from the sale of salt spring lands, $988,000; from the federal government and from the sale of lands donated under the Morrill Endowment Act $919,000, making a total of nearly two mil-

lions of dollars. By the terms of the second Morrill Bill the College receives this year $22,000, while from the Hatch Experiment Station Bill she receives $15,000, all of this in addition to about $44,000 received from the interest of the sales of lands under the first Morrill Endowment Act.

We are a part of the fruits of that lavish expenditure of money, and while we find ourselves today gathered here asking ourselves if our expenditure of time and money has paid us, it might be well to ask if it has paid the State and the Nation, who have been so liberal to us? It is time that we as friends and beneficiaries of this new education should fairly and honestly face the problem of the present status and future usefulness of land grant colleges.

Today the College asks but little of the State legislature. Last year its revenues, aside from anything that came from the taxpayers of this State, amounted to six per cent interest on nearly one and one-half millions of dollars. An institution today with a million and a half of interest bearing bonds is indeed rich, and should do its alloted work well. Our College has gained a vantage where her feet are firmly planted, and she may calmly and proudly search for her mission. When in the past she has kept in touch with the spirit of her founders to furnish an education of the head and hand to the young man of small means, this College has succeeded, but it is useless, and actually contrary to the spirit upon which it is founded, for a land grant college to compete with a university. When they have been yoked together, or when the land grant college has been swallowed by the university, a perversion of funds has taken place which is little less than criminal.

Fortunately in this State we are unhampered, and Michigan has a chance to lead as she did forty years ago. Unless I misinterpret the spirit in which these appropriations were given, the object of the land grant college should be, not to make professional men or farmers, or mechanics or mechanical engineers, or to compete in any way with the university; but to me it seems as though its objects should be to take the young men and young women just as they come from the common schools and give them four years, more or less, of training for the head and the hand, with the aid of the best appliances and the best teachers that modern scientific methods can produce. So that they shall go out into the world better equipped for its duties, and better citizens. We cannot bear down too hard on this latter side of the education. For assuredly the government has a right to expect such institutions will send forth men filled with patriotism and ready for the active duties of citizenship. If at the end of that course they see fit to go on farther, the university is open to them.

To my mind we have been too ambitious. We have trained in the past some splendid men who have gone out into positions of trust and honor. But unless they had a more extended training in some institution more in the nature of a university, they have fought their way up against tremendous odds. When the later Morrill Act and the Hatch Experiment Station Bill gave a new impetus to land grant colleges there arose a great demand for teachers in these schools in the various branches of scientific work. The graduates of our College were ready and willing; many of them had had experience in teaching, and they secured a fair share of the places. These men have many of them done good work, but they have been seriously hampered by the idea that they were graduates

of a first class college, and needed no farther training. The real fact, and the one which they soon discovered, was that with their preparation on entering this College they could not in four years have mastered anything, and what they most needed was thorough, systematic, persistent study in their chosen branch of science. They have done well and they have reflected honor on the M. A. C. But they have done it at the fearful cost of days and nights of double work. Witnesseth the tragedy of an Ingersoll, wonderfully successful, a born teacher and leader, but always striving to make up for deficiencies of early education, until body and mind break down.

The success of our College in sending out teachers and engineers of ability has to a certain extent blinded us to the true end and object of a land grant college. It has seemed to us glory enough if we pointed to teachers in nearly every state of the Union. If we but stop to think this is but an incident in our mission, it is a thing to be proud of, but is it the thing of which we ought to be most proud?

As a college, over five thousand young men have entered our doors. Something over seven hundred have graduated. Why have the four thousand dropped out? Has the course been planned for the many that come, or for the few that are chosen? Of the seven hundred who have graduated, how many would have received their education at the university? Of the many who have dropped out, how many would have remained if the school had been peculiarly designed to help and to keep them? These are questions well worth asking.

It is openly and freely stated that with our magnificent plant and equipment, and the vast amount of money spent annually, we ought to have a thousand students. There is no doubt but that this is true. We can only have this number when we come into closer touch with the sons and daughters of men who are earning small sums of money.

The ideal of every ambitious student and teacher is to increase the requirements of his college, and to add to the course of study, even though many drop by the wayside, and only the strong and brilliant few graduate. The college gains a higher rank among educational institutions. I would call a halt along this line. I would lower rather than raise the requirements; I would lower rather than raise the course of study; I would discourage the graduation, from a four years' course, of men fitted to take at once the first prizes; I would even make the requirement so low that no earnest young man or woman should go away because the course was too difficult. Educators recognize that many youths can learn from things who cannot learn from books. An institution founded for the purposes set forth in the Morrill Endowment Act is doing its work when it provides for this class. Expenses should be simplified and reduced, so that any earnest young man of good health can earn the money to go through.

Do you know that the expenses have increased during the past ten or twenty years? It takes more dollars to graduate a young man now than it did then. And there are those who are free to talk of the greater purchasing power of the dollar, but that is another story. The course has been extended and the price raised, that is to say, we have come nearer to the standard of a university, and farther from the reach of the sons and daughters of that grand industrial class spoken of in the Morrill Acts, and in whose ranks the brain and brawn and moral fiber of this country exists.

It may seem a peculiar spectacle for an avowed friend and beneficiary of a college to openly advocate a lowering of the standard of excellence, and a cheapening of expense to the student, but unless we can do this, we are simply competing with the university on its own ground, and we shall be beaten. Such competition is not the business of a land grant college. We must seek out our mission, and carry it out regardless of pride or prejudice. Where we have tried to equal or excel the university we have in so far failed in our fundamental object and design.

You will say, this is a practical world, and that the training must be of such a character that the men and women who go out shall be able to earn a salary from the day of commencement. That because we do not offer some money-earning profession to our graduates our number must of necessity be limited. You will say that, for instance, a normal school has a distinct advantage, and in some respects this is true. But compared with our school, the design of any other in this State is indeed narrow, for here we should provide a practical education for the largest and best class in our country. It must be possible to design a course which shall interest the best activities of young men, and which will keep them in touch with the best educational methods, all with the expenditure of a comparatively few dollars, and make it practicable for any young man or woman of small means and moderate ability to obtain an education which will fit him for the moderate successes of life, and open up for him vast possibilities. We have heard almost too much about training leaders and educating first class men. The rank and file of men need some kind of an education, and we must provide some place for the great army of second class men.

The success of this school in the past has been wholly in the hands of its Board of Control and its Faculty. Is it not time that they had the advice and criticism of an intelligent alumni. It has been our custom during the past to meet at least once in three years, to congratulate one another, and to have friendly intercourse. Shall we stop here? Have we not arrived at a time when these meetings should be productive of something more than mere reminiscences? Is it too much for us to demand that the alumni have an active and earnest part in the management of this College? We are no longer children. Already there are gray heads and bald heads among us. Already there are many who take pride and pleasure in shaping our governmental affairs. Shall the college which did so much for us in the past be forgotten? We owe it to our boys and girls to give this institution the benefit of our experience and our best efforts. Have I gone too far in asking that as alumni we do all in our power to keep this institution close to its original purpose, and close to the great industrial classes for whom it was intended?

We would all feel gratified if we could know that our Alma Mater was spoken of as one of the first colleges in the land, but have we not a higher duty in securing for our College the reputation of doing, in its particular line, the most good of any institution of its kind in this country?

Shall we by this course lose some students? Undoubtedly. But we would gain ten where we lost one. If a young man don't like the sort of an institution which this was designed to be, he ought not to come here.

Let us assume for a moment, which is not true, that all the bright boys will go to the university? Is there no place for plodders? Let us assume

that the university can turn out all the first class mechanical engineers we need, is there no place for the young man who simply aspires to be an educated mechanic, or who don't know what he does want, but only knows that he has large aptitude for things, and but small aptitude for books? Our school can hardly take the place of the old apprentice system, but it can do far more and better. It cannot hope to take a boy who knows nothing of the farm and graduate him a successful farmer, but it can furnish, as it has in the past, to a young man who expects to work his forty or eighty acres, an opportunity to spend a few very profitable years at a trifling cost aside from his time, and it can send him back to the farm with health benefited, mind enriched, and spirit contented, a better citizen in every sense of the word.

If the tendency of our College has been to increase expenses and enlarge the course, let us get back to cheapness and simplicity, and to less ambitious tendencies. Not less thorough, but less advanced.

Why can't a boy who likes farm work and wants to become a farmer and a citizen, find an institution of this kind profitable to him, even if he cannot follow equations in algebra?

Why not give an opportunity to young men to learn all the details of the dairy and creamery business, even if they can learn but little of rhetoric? Why not send boys out fitted as good mechanics, even if they can't adapt themselves to abstruse mathematics. The large attendance at private schools of meagre means and equipment proves that young men of today need such an opportunity. Men who are in a position to know tell me that it is difficult to get well trained mechanics today. If a young man has been to college, he wants to be a superintendent, he has been educated too far to work at the bench. To my mind there is room for an institution which shall do this work without pretending to send its young men out with the full equipment of university graduates. Unless I am mistaken it is the province of these very land grant colleges to do just this kind of work.

Personally, I wish we could change the name of our college, broaden it. Instead of the Michigan Agricultural College, I would like to have it called "The Michigan School of Applied Science." We received this million of dollars from the federal government for a broader purpose than a mere school of agriculture. We have been justly and unjustly criticized by our farmer friends, who seem to think that they own the whole thing, when as a matter of fact there are others in that broad term, industrial classes, and we ought to spend the same effort in trying to instruct and help the sons and daughters of mechanics, and miners and laborers of all kinds. We have been a little too narrow. Is it not possible that educationally we have advanced too rapidly? We have no great secondary schools in this country. We seem to run to universities. Why not make this school for Michigan, what Rugby and Harrow are for England, a great intermediate school where the modern methods are brought into prominence, and the discipline of things takes the place of the discipline of Greek and Latin. It takes a far better teacher to educate a young man in science than in language. A teacher who knows but two years of Latin can impart fair instruction so far as he has gone. But a man must be a master of science before he can give his pupils any valuable discipline from his work. The rarest teacher is the first class kindergartner, no half knowledge will do here. The teacher must

be possessed of the very spirit of Froebel. But with such a master kindergartner, what marvelous results are obtained. Instead of an inferior kindergartner, one had better go back to the old and painful A B C method. So it is with the work of this school. No lowering of the standard—great teachers will be needed. They have not been absent in the past, they will not be in the future. The difference between the kind of training which I would advocate, and which has attributed in a large degree to the success of our graduates in the past, is illustrated by an incident which came under my observation. A graduate of a university, a good scholar in Latin and Greek, and an engineer besides, had occasion to run a line of pipe filled with super-heated steam under and through a wooden building. He wished to pack the pipe to conserve the heat. Asbestos was too expensive, but he had plenty of wood shavings. The question arose, at what temperature will the shavings ignite? He pulled down every book in his library, he wrestled with complicated formulæ, until finally a graduate of this college fixed up an oven which would keep the shavings for twenty-four hours at the temperature of the steam pipe, and said, "Why don't you try by actual experiment?" It was worth a library filled with books, but the training of this university man had not taught him to think of such a simple plan.

With this great intermediate school I would have at the same time, like a lofty spire that points the way, a magnificently equipped and organized experiment station, let the Hatch fund be used in scientific research, let an equal or greater amount be secured for experimenting along the line of mechanics. If money can't be obtained to spread over the whole field of scientific research, let it be confined to one point, but let it be so managed that the results shall obtain the respect of the scientific world. Such a center, doing splendid scientific work, would give the school a world-wide reputation as the great intermediate scientific school. Such a school would fill a vacancy in our educational system, and would fulfill the great purpose of this splendid national extravagance. We would again set the pace for the rest of the states to follow, and we would do more for the young men and women of Michigan than any school in the State.

Brother Alumni, and friends of the college, I have spoken only my views after some experience and some reflection. Not one word has been spoken in unkindly criticism. I appreciate the fact, that, like many others who have had its benefits, when I entered this school I could have gained an entrance to few other colleges. I would enlarge, not restrict its scope and power of usefulness. The teachers, from Dr. Abbot to the present corps have been men of marked ability and tremendous enthusiasm. I only ask that we do not permit the spirit of rivalry to the university idea to grow upon us. I ask you to call emphatic attention to the fact that we are a peculiar people, and that we have a peculiar mission to perform. I understand that many wiser and abler than I, will differ widely from me in this plan of cheapening the price, lowering the course, and enlarging the scope of this school. I appreciate the fact that many of the best friends of this college fondly dream, as I once did, of a time when this institution shall have gained a place among the first colleges of the land. That dream for me is passed, and in its place I substitute the ideal of a great institution of moderate ambitions, but of marvelous activity, gathering in young men and young women,

who would otherwise have no such inspiration, and sending them out into the world better fitted to cope with its difficulties, and better citizens in every sense of the word.

I have been led to say these few words from what I deem the proper interpretation of the act whereby we have accepted so liberally of the funds of our national government. When we accepted those funds, we accepted a trust for which we must account. The industrial classes of the State of Michigan form a vast army: farmers, mechanics, miners, laborers of all kinds. The schools of the State from kindergarten to university are open to them, but it is to this institution that they have a right to look for an opportunity to gain that practical knowledge of things which can only be acquired by coming into actual contact with the appliances of the farm and garden, and shop and laboratory. This institution is, it seems to me, essentially for them.

The keynote of Dr. Abbot's character was simplicity, and genuine, honest modesty, and he left an indelible impression on this college. It is useless to ask what the influence of a Kedzie and a Beal has been. The present faculty will, I venture to say, go a long distance with me in this plan for a great intermediate school. The Board of Agriculture have always been close friends of the people and of this college, but spite of it all, the tendency has been toward an expensive course, and toward a competition with the university. It is to the alumni that we must look to help bring it back, if such a plan is desirable. We are of the world and in it, and we can keep in closer touch with the needs of the people than any one more directly connected with the college. Does it not seem to you that we in Michigan need an institution, which shall, without the slightest false pride, attempt to give to the young men and the young women of this State a practical modern education of head and hand? This calls for no revolution, it simply means that from now on the tendency shall be back to simplicity and down to the needs of the students for whom we are organized. If the tendency has been to increase expense and enlarge the course, let us get back to the cheaper and to less ambitious methods. Is it not possible to realize the dream of its founders, of a great, low priced, high grade school of applied science for the children of that vast army, the industrial classes?

THE AGRICULTURAL STATUS.

BY PROF. L. H. BAILEY OF CORNELL UNIVERSITY, M. A. C. CLASS, '82.

[Address at Annual Commencement Exercises, June 18, 1897.]

The agricultural status is a subject of perennial alarm. It is Banquo's ghost of the economic world. It stalks the earth by night and day, and points its fingers to the abandoned farms of the East, the despairing unrest of the West, the depopulation of the rural communities, to the fall in prices of farm produce, to the contrasting ease of the city man, and then fixes its hollow eyes upon the foreclosure of the farm mortgage and follows the halt and broken couple to the poor-house. It runs up great columns of figures which silently emphasize the decline, adding into one sum all the economic and social ills of a generation. In the intervals there comes the angel of hope, sweet-faced but sad, who prescribes a remedy for each of the ills; yet we are not comforted because we are not enlightened. It is all a nightmare, and nightmares are past finding out.

The trouble is that we are fixing our eyes upon the symptoms, and we are giving treatment for the fever, but are not discovering the cause of the septicæmia. We can rarely effect a permanent cure by confining ourselves to symptomatic treatment. We must find the cause of present disaffection or we cannot hope to administer permanent relief. Few of the facts which are commonly cited as determinants of the agricultural status are really causes; nor do I believe that we shall arrive at the fundamental difficulties by study of the statistics of production and population or by examination of legislative history. If the difficulties are ever solved, I fancy that they will be apprehended by some bold spirit who arrives at his conclusions by inference which will need neither defense or proof.

I.—THE CAUSES OF THE DECLINE.

It would seem that the first question to consider is whether there really is an agricultural disease; that is, whether there is any grave economic trouble or disorder which is peculiar to agriculture and which must be remedied by means wholly different from those which are invoked for the cure of other economic ills. Every man who has thought seriously in this direction has arrived at an independent conclusion, in which we find the resultant of the forces of the man's education and environment. For myself, after a prolonged study of the question, I am convinced that there is no agricultural disease. This is not saying that there are not grave difficulties and discouragements in the agricultural status, but these difficulties are not such, in my opinion, as demand fundamental legislative treatment. We can best understand the subject by making a review of some of the changes which are commonly associated with the idea of an agricultural decline.

An agricultural community stretched along the shores of Cayuga Lake, and it prospered. The countryside sloped away to the rising sun, glad

of every new day because it added to the contentment of living. The farmer and several sons managed a farm of eighty acres, twenty of which were still in forest, and in haying time and harvest they hired three or four hands and worked at the job, off and on, for a month. They raised a few acres of corn, and wheat and oats and potatoes, with three or four native cows, and a hundred weight of maple sugar. The grain and pigs were sold in the neighboring hamlets or carried to the boats which plied between the villages and the Erie canal. Once a week—and oftener in circus time—the family drove Dobbin and Topsy to town in front of the lumber wagon, and traded the butter and eggs for the few necessities which the farm did not produce. The boys went to the red school house three months in the winter to thrash the teacher, and incidentally to master the rule of three, and to make another effort to get as far as syntax. Happy days! The world was bounded by the misty horizon of the lake and by the distant hills!

A railroad invaded the community. A steam engine took the place of the water wheel, and behold! the horizon opened and the world appeared! The mighty forces of a rising industrial empire rushed in, and every social and environmental condition was upset. The boats were taken off the lake, the wharves fell to decay, boots and shoes were sold in pasteboard boxes, the minister had a new theology, the wheat and the pigs of the West went by the doors to the city, and the boys caught the unrest of the time, followed close behind. The invasion of a new economic condition over-ran the country, and the farming community, conservative and slow of apprehension from its long inactivity, was engulfed; and the full readjustment has not yet come.

The mainspring of this new movement was mechanical invention. The manifold applications of the steam engine, the building of railroads, the evolution of manufacture, carried new ideas and new methods to every man. The shoemaker no longer made shoes, the tailor no longer made clothes. The scythe and sickle were hung on the fence and the mowing machine and the reaper took their places. Transportation and manufacture brought people together. Everyone was attracted by the new life. The cities grew. They gathered to themselves all the quickening and nervous energy of the time. Thither the farm boys and the farm girls flocked. I do not blame them, for I went, too!

I do not blame the butterfly if its seeks the flower, nor the moth if it flies to the candle, nor the bird if it revels in the color and perfume of the tangle, nor the brook if it tumbles pell mell into the sea. All things must find their level, and all must live where life is best and where struggle for existence is least.

The farm no longer needed so many boys, for two men can do the haying in a week and ride to town on a bicycle after supper. But the serious part of it is, for agriculture, that the brightest and most ambitious boys went to town. They were the ones who were anxious to learn. In fact, they must learn, for business was new. The intellectual awakening was itself a reward. Schools of mechanics arose and soon were crowded, fed by the ninety per cent. of the boys who had left the farm. The ten per cent., or thereabouts, who remained on the farm, could not fill many agricultural colleges and there was little instruction which, in novelty and immediate practicability, could compete with the other. The rise of the school of mechanics was the legitimate fruit of the time.

When men and industry went to the city, capital went too, and the country was like the shell of the cocoon when the butterfly has flown.

There is another phase of this migration which seems to have escaped attention, and an understanding of which will save us much anxiety and prevent the drawing of many false conclusions. The farmer is his own master. He works for himself. As a rule, he does not employ more than one or two men, and these not permanently. Comparatively few men are endowed with talents which fit them for the executive management of a business. Consider the young men of any rural community. How many of them can manage a business? How many can sell the produce of a single farm to advantage? These men go to the city, and are employed. One in a thousand—nay, one in ten thousand—rises to the ownership or directorship of the business; we all compare the farmer with this one! You contrast the condition of the small farmer with that of the manufacturer; must you not rather contrast the farmer with the workingman or the tradesman? Must you not compare one man with one man, one dollar's capital with one dollar's capital, not one man with the combined productiveness and vital force of two hundred well-trained men? The manufacturer makes money not only from his wares, but from his workmen. Men are part of his capital, which, by superior tact and skill, he makes productive. The farmer has only his wares to sell. Compare the average John who went to the city with the average John who stayed on the farm, and the farmer will not suffer thereby. And the average Jane—well when John went, Jane went, too!

We must remember, too, that the farmer's business is generalized. The farmer is proprietor, capitalist, warehouseman, employer, laborer, all in one. The business man is a specialist, and meets competition at one point. The farmer meets competition upon all sides. One man cannot be four or five men with advantage to himself.

All the shifting unrest of this transition period was intensified by the sudden opening of the virgin lands of the West. The great new country must be settled, and lands which, had they been in the East, would have been worth one hundred dollars an acre, were almost forced upon the home-seeker. This came at a time when the armies of the Civil War were disbanding, and hundreds of men who had no ties of land or business hastened to the country beyond the Mississippi. The result was that the eastern country was again drained of its young men and its capital, and the West was settled too rapidly for its own good. Speculation, which is wont to precede the agricultural occupation of the country, became a passion. It was an experimental era, and experimenters rarely make money. Men took up too much land. The markets were far removed. Only the staple products could be grown. The vagaries of the climate were not well understood, and in the absence of judicious management of his conditions, and in the presence of many circumstances beyond his control, the farmer either produced enormous crops or almost failed. Such unstable and unpredictable results produce unrest. The mortgages of the speculative era matured, and the over-stimulated town collapsed. The crisis has come; and since manufacturing interests are small, agriculture takes the brunt. It is the natural result of over-development, of too rapid and too fictitious settlement. The discouragements may be very great; but although there are various emollients, which may soothe and pacify, the only complete healer is Time!

Great movements and readjustments similar to these are frequent in nature. They follow in the wake of man. There is universal and intense struggle for existence. Any plant or animal left wholly to itself would cover in a few years all that part of the earth in which it can live; and thereupon there would arise a fierce conflict with itself. But there are thousands upon thousands of plants and animals, each intent upon one purpose of perpetuating its kind. Clear off the forest, and how quickly the pokeweeds and thistles spring for the opening, and how intense the conflict! New countries abound in such readjustments. The early New England had its scourge of caterpillars, our own Northwest has its Russia thistle, Australia its rabbits, Jamaica its mongoose, the Pampas their cardoons, and Egypt had its plagues; and every farm repeats the story on a smaller scale. After a time the readjustment comes, equilibrium is again established, the invasion of the Canada thistles is checked, and the Junegrass covers the battle ground with a mantle of victory.

There was an economic equilibrium. One hand served the other. A cloud appeared upon the eastern horizon, and as its outlines became distinct, it was seen to be twain, and each half matured into a hurricane —one part of the great industrial awakening following the era of invention, the other change of place or migration resulting in the opening of the vast West and of the uttermost parts of the earth. The new enterprises—manufacture and its train—fitted themselves to the new condition because they were new, but agriculture—oldest of arts, stereotyped and hardened by the traditions of centuries—agriculture went under the wave, and she is just now emerging, dripping with the tears of her sorrows, but with her face towards the rising sun!

II —THE PRESENT STATUS.

We come, now, to this new birth, to this time of hope in knowledge and science;—and what of the future? We may not prophesy until we take account of our present status. Are the conditions of agriculture so bad as they have been pictured to be? No, not to my thinking. There are unusual hardships in regions where there have been unusual disturbances, but, as a general statement, the farmer is as well off as any citizen who expends an equal amount of capital and effort; and if he is not, the remedy is not complaint nor recrimination, but an earnest and patient effort to undo the wrong. This cry of the hardships of agriculture is not new. Its refrain wails throughout history. The husbandman is at first the maker of society; as the social condition becomes complex he becomes a serf, then a peasant, and finally, in America, a landholder and an enfranchised citizen. Virgil sketched this evolution:

"For ere Jove's day, no hind the land compelled,
Nor might he stablish a landmark, nor divide
His holding from his fellows; but all, as one,
Wrought without question, and the earth satisfied
Richly their needs. Now those old days are done;
Jove to the serpent his black poison gave,
Bade the wolf prey, and lifted the angry wave,
And he smote from the trees their honey-dew, and hid
The fire in the rock, and the running rivers of wine
Shut in strait channels. And all these things he did,

That man himself, by pondering, might divine
  All mysteries, and, in due time, conceive
The varying arts whereby we have leave to live;—
* * * * * * * * *
Yet even upon the grain fell plagues ere long,
  Mildew defiled the stalks, and everywhere
  The barbed thistles gathered in lawless throng,
  Till villainous weeds displaced the harvest there
Caltrops and cleavers, darnel, wild-oats forlorn,
  Darkened the gracious glistening of the corn."

Pliny lamented the decline of fertility of the land, and suggested the cause to be the decline in the skill and intelligence of the farmer. The cause was, "we have every reason to believe, that in those days the lands were tilled by the hands of generals even, the soil exulting beneath a plough-share crowned with wreaths of laurel, and guided by a husbandman graced with triumphs; whether it is that they tended the seed with the same care that they had displayed in the conduct of wars, and manifested the same diligent attention in the management of their fields that they had done in the arrangement of the camp, or whether it is that under the hands of honest men everything prospers all the better, from being attended to with a scrupulous exactness. * * * But at the present day these same lands are tilled by slaves whose legs are in chains, by the hands of malefactors and men with a branded face!"

Our own country has had similar history. A hundred years ago, Deane wrote of the agriculture of New England: "The alarming effect of the present low state of husbandry is, that we are necessitated to import much of our food and clothing, while we are incapable of making proportionate remittances in the produce of the soil, or in anything else."

An English traveler wrote of us in 1801, that "land in America affords little pleasure or profit, and appears in a progress of continually affording less. * * * * Land in New York, formerly producing twenty bushels to the acre, now produces only ten. * * * Little profit can be found in the present mode of agriculture of this country, and I apprehend it to be a fact that it affords a bare subsistence. * * * Decline has pervaded all the states."

We dwell upon the time when presidents were taken from the farm and returned to it with joy. We recall the beautiful rural simplicity of Cincinnatus and the many noble Romans, and of Washington and Jefferson; and since these instances do not recur, we lament a decline. We should remember, however, that the young Washingtons now go to the city to learn a thousand things—alack, that some of the things are so little worth the learning—of which their elders never dreamed. There was little else than the farm to which one might retire in those days. In Washington's time, the trinity of opportunity lay in agriculture, theology and war. The two first books upon American agriculture were written by ministers. There seems to have been a decline in all these worthy occupations, and books on agriculture are now written by cranks and professors.

It is really fallacious to compare the prosperity of this generation with that of the one before it. The farmers of that time were happy largely because they knew nothing better; now many of them are unhappy because they cannot attain the things which are far beyond their reach. My older hearers know that the amenities of the farmer's life have increased a hundred fold within a generation.

Let me call your attention to the fact that there are various kinds of wealth. One type is the bank account; another is sweet contentment, peace of mind, and joyous living. The latter is none the less real because it cannot be figured up. Every man sooner or later feels the need of it. He may not need it in the morning, but the need and the desire come as certain as the sun reaches the zenith, and it is the only solace at sunset. This is no idle fancy, else why do the manufacturer and the merchant long for a country home, and why do so many men come back to the farm when the years have cooled their heads? The farmer's wealth is not the city man's wealth. It is not of the kind that feeds ambition and makes display. Farming does not make men wealthy in gold; but it may make them comfortable and happy. It is a pernicious evil, this custom of measuring a farmer's success by the money he has. A large part of his wealth is in the daily living. We are measuring agriculture by wrong standards. Here is a realm of living which lies beyond gross ambition, beyond the greed of wealth, a place where unselfish patriotism may grow unchecked. The future must see comparatively fewer colossal fortunes and more financial thrift in the commonality of the people. There is certain to be great change in society by means of gradual evolution, and those pursuits which are most conducive to useful and contented lives are certain to exert greater and greater influence. Give the farmer some leisure in which to think, and then give him a desire to think, and the farm is no longer an inuendo. But at the present time the farmer may be addressed too often in the language of Ulysses to Laertes: "Great is thy skill, O father! Great thy toil. On every plant and tree thy cares are shown; nothing neglected but thyself alone!"

You may think this good teaching for Sunday, but it will not raise bread and butter for the week days. You tell me that the farmer cannot make his expenses, and cite me to wheat at seventy-five cents a bushel. If the farmer cannot grow wheat and live, he should certainly spare himself the effort; but it may be profitable to examine this question, for it is the one most frequently cited in support of the assumption of an agricultural disease. The Cornell University estate was a run out hill farm not many years ago, advertising its shame by fields of ox-eye daisies. It has had no "fancy" treatment, and only small applications of concentrated fertilizers; but it has had most skillful management. For fifteen years the average wheat crop upon the regular fields of the farm has been thirty-six bushels per acre, and the cost of growing and securing an acre of wheat has run from twelve to fifteen dollars. Assuming a price of seventy-five cents a bushel—which is under the average—the return from the grain is twenty-seven dollars. Straw sells readily in central New York for five dollars per ton, and the average is two tons to the acre. Here is an average income of thirty-seven dollars earned by the expenditure of thirteen dollars, and the capital stock grows better for the using. Adjacent land, of the same original quality, can be bought for thirty dollars and forty dollars an acre, or for less than twice the net earnings of any year. Two men, with modern implements, can perform the regular work upon a hundred acre grain farm. If sixty acres are in wheat, there may be an average net earning of $1,440; leaving forty acres for other uses, from which the incidental produce should buy the incidental necessities. This is an unusual case only because of

the unusual average yields, but other men should get approximately these yields if they know how to raise wheat. I venture that there is no legitimate commercial business which is capable of yielding a greater income on the capital and time invested than the raising of wheat in central New York. Dakota does not compete with the New Yorker who raises thirty-six bushels to the acre!

The secret of the whole matter is raising more wheat for less money, and then the securing of sufficient land to produce the desired income. This raises several serious questions, and brings us at once to the very heart of the current discussions respecting the agricultural depression. There is said to be an overproduction of wheat. If there is, surely the only remedy is to grow less wheat; and the lesser production will come when the price falls to a certain point. The whole question of production and demand is a relative one, and it may be expected to regulate itself in the long run by the natural laws of supply and demand. This is not an agricultural question, but a commercial one. It arises in connection with every manufactured product as well as with wheat. In like way, the number of farms and farmers will regulate itself; and this fact takes the point from the customary calculations which predict the time by comparing the increase of population with the number of farms, when it is expected that consumption will overtake production and the farmer will be prosperous. You may cite me to the fact that capital in farms is less flexible than in manufactories, and that lands cannot readily change hands; but I reply that while the land itself is a comparatively fixed investment, the kind of products which one shall produce is more flexible than in other businesses. There cannot be permanent overproduction. Society is a self-sustaining organism. If agriculture adjusts itself to new conditions more slowly than other interests do, the adjustment nevertheless must come.

An important point to consider in this connection is the fact that a relative overproduction presses hardest upon the poorest farmers—upon those who are raising the least per acre and who are thereby nearest the verge of collapse. The man who grows thirty-six bushels of wheat to the acre may keep at the business, while the man who grows twenty bushels goes to the wall.

The complaint of overproduction is often only a misinterpretation of a misunderstanding of the market, and a consequent inability to sell, or it may be the measure of the inferiority of the product. I know a farmer who last year grew one hundred bushels of potatoes to the acre and has them in his cellar now. Another farmer grew three hundred and fifty bushels and sold them from the field for eighty-two dollars. The man who raised the less complains of over-production and now plants beans: the man who raised the more now doubles his area. The former is being crowded out in the inevitable struggle for existence, and agriculture will be the gainer when he moves to town. There, under the hand of an employer, he may succeed. He is of no use on the farm except as a hireling. It is the pinch of necessity which is clarifying the country.

We have been taught, I fear, that agriculture has some Divine right which other occupations have not. We must not deceive ourselves. Everything must ultimately stand on its merits. Our civilization is one thing, one structure, in which all the parts are working together for the good of

man. It stands upon a tripod of industries, agriculture, manufacture, transportation. We need no class legislation. We cannot stem the tide which rises from the nature of things and which carries all human endeavor upon its bosom. We may only change the ripples which here and there play over the surface and obscure the mighty under-current. And as for agriculture—it must pay, for there must be agriculture!

The example of the wheat farm brings up another vital question—the amount of capital invested in the ordinary farm. One hundred acres of average farm land in the eastern states is worth four thousand to five thousand dollars. The equipment is worth one thousand dollars more. Upon this investment of six thousand dollars, the farmer lives in substantial comfort and rears a family; and he often lives upon half this capital. His productive labor is comprised within eight or nine months of the year. What other form of investment shows a like return?

You may grant this, but reply that if the farm is mortgaged the interest takes the bread from the children's mouths. The same remark applies to any business. Mortgages are sometimes indicative of agricultural hardships and sometimes not. The farm mortgage is commonly misunderstood. In the West, as already indicated, it is often the legitimate offspring of speculation and over-development; and the mortgage was given on a rising market and is being paid on a falling market. While the result is serious, it cannot be cured in a day. It will right itself only with time. The present stringency is making investors cautious in loaning upon real estate, and farm mortgages may be expected, therefore, to be fewer and smaller in the immediate future. In the East, the question of mortgages upon farms is not essentially different from the general question of doing business upon borrowed capital. Many of the mortgages represent the purchase money of the farm, and are carried decade by decade, and possibly even generation by generation. Most of the business of the world is done upon credits. If the merchant trades upon borrowed capital, why may not the farmer plow upon borrowed capital? The chief difference in the result has been that the merchant foresees a downfall and gradually works into another business or prepares to assuage the blow; the farmer hopes against hope, maintains the same methods, stands the same ground, until the sheriff sells him out.

Statistics of mortgages must be studied with the greatest caution, for it is a fact that many mortgages which have been paid never have been discharged; and thereby they remain upon the records. The greater the number of mortgages in any community, the more emphatic the evidence of business done upon a credit basis. Mortgages are evidences of faith in the paying power of farming.

III.—THE READJUSTMENT.

We have seen that the agricultural question is an old one; but the ills of former times were chiefly those of poor farming and bad social order. Our present ills are poor farming plus mal-adjustment to a transition period in the history of the world. Is there any evidence that readjustment is taking place? I think that the evidences are abundant. We have all seen them, but have too often interpretated them to be evidences of disease and decline. We must first understand the movements

of the time and then consider that agriculture has no absolute or fixed methods or standards. We mourn the evidences of departure from the good old ways, but we should rather rejoice in the thought that ways which are adapted to one generation are not necessarily adapted to the next.

1. The first and most striking evidence of the readjustment is change of place of population. We have alrêady considered it. We have now only to remark that the city is the place in which one is to attain those acquirements which we call culture. It is a hopeful thing that so many of our people desire this culture. Would that they might all go to the city for a time! But the artificialism or conventionalism of the city excites the nerves and chokes the sensibilities; and there is now a marked tendency, at least in the East, for persons to move countryward. There has thus arisen what Ward has called a ruralization of the city, and an urbanization of the country. The country is most appreciated by the best minds. Capital is slowly crawling back to the country here and there. The flood tide has passed its full and the ebb is now setting in. This migration cityward, of which we have feared so much, is the very force which will unify our people and vitalize our democracy.

The ebb tide is setting back from the great West. The prairie schooner, bound for the setting sun, has been laid upon the dry dock, and the movement is eastward rather than westward. People are gradually outgrowing the habit of moving. It is the second settlement of a country which makes for its permanent progress. Farmers upon virgin lands are often robbers. They unlock the storehouse made pregnant with the accumulations of centuries, take the gold and silver and the precious stones, and hurry on for new conquests. By and by they come back and delve out the lead and the iron, and apply science and skill where before they used hammer and dynamite. English land is more productive now than it was in the days of William the Norman. Our eastern hills are not dead: they only wait for science. And this very day New York has better farms and better farmers and a safer, and thereby a better agricultural status than it ever had before! They tell me that the wheat lands of the great West can no longer raise wheat. The sooner the fury of the gale is spent, the sooner will fall the gentle shower!

2. The unequal development of different parts of the country is a sign of the effort at adjustment. New England suffered because its granite hills were too expensive of cultivation, and its water powers and its urban population invited manufacture. The great West suffered because of too rapid settlement. The great South has not yet recovered from the effects of war and the complete overturning of its social system. Special localities here and there suffer for special and local reasons. Time is slowly healing the wounds.

3. The abandonment of eastern farms is a direct adjustment to the times. These lands are comparatively unproductive, and the cost of working them is great. Yet they are capable of yielding a small profit per acre, and it is only a question of how many acres a man shall have, to produce the living which he desires. The abandoned farms are often bought by city people for country homes, but they are also being purchased by farmers for grazing ranges. Many of them will some day come again into a thorough state of cultivation. There is a segregation,

in many localities, of the smaller holdings into comparatively large ones. This movement is comparable, to my mind, to the segregation of small factories into large ones, and instead of causing alarm, it should be looked upon as the natural and logical result of new economic and social conditions. We are apt to let feelings of sentiment influence us when farms change hands, while only commercial instincts are aroused by changes in manufacturing or mercantile business.

The segregation of estates in various localities, has led to the fear that we are approaching a system of landlordism, but we must not forget that upon the more fertile lands and near the markets, farms tend to grow smaller and the system of management to become more intensive. The absence of the entailment of estates and the presence of popular suffrage may be expected to be permanent safeguards against landlordism; but I shall be glad of the time when capital and skill shall direct large rural enterprises in the remoter parts of the country. This has no bearing upon the peasantry question which so many prophesy will come upon us, for the necessary element of peasantry is not small holdings, but social conditions. What the final outcome of farm holdings is to be I do not know. I only know that competition will increase, that great new problems will arise, and that the world is growing wiser. The civilization of the coming centuries will not be the civilization of today, and we must not attempt to prognosticate it by the ideals of today. One part of that great organism will be agriculture, but how great a part must be left to the future.

4. Another proof of the reconstruction of agriculture is the growth of specialization, and in particular the evolution of horticulture. The production of bread stuffs and other necessities must be regulated by the demand, but I hold it to be good economics to say that in the luxuries and the amenities the supply creates the demand. Here is one great check from drifting into peasantry—the possibility of maintaining one's self upon a small holding while still retaining one's autonomy in the economic and social structure. Upon the one hand, therefore, I look for segregation of estates and large area farming, and upon the other for division of estates and small area farming. In any case, we need to heed Virgil's advice:

> "And howso broad the acres of thy desire,
> The few are better for tillage."

5. Still another proof of this readjustment of agriculture to the new-time civilization is the sequestration of the district school. The old red school house on the corner, flanked by the woods and the fields of corn, battered and scarred by generations of scholars, the arena of the mighty intellectual combats of the lyceum, the paragon of knowledge—how we love it! How memory reverts to the master with his unimpeachable wisdom and his unescapable rod? How the boys and girls romp again along the roads and over the fields! The years have dimmed the picture only to make the few colors stand out more clearly, and we cherish the incidents because our feet are so rapidly carrying us down to the sunset.

But the finger of time is laid upon the old red school house, and its days are numbered. Not all the boys are needed on the farm any more. We have mowing machines and riding plows, and one man does the

work of ten men and does it better; and when the boys are not needed the girls are not needed either. There are too few scholars now to maintain the inspiration of the school, and we cannot afford the best of teachers. In the towns the schools are growing better, and the district school cannot compete.

Shut up the old red school house! It is a milestone in our progress, but milestones are dead. Shut up the old red school house! The hamlet school is the rural school of the future, and it will be the guiding star to our children's lives as the district school has been to ours. If the country is wide, hire a man and team to gather in the children from far and near. Bring them to the school: we cannot longer take the school to them. Let us fall in with the movement of the time. We cannot stop it if we would: we can make it serve us if we will. We must not let our theories of what ought to be, obscure the importance of what is.

IV.—THE REMEDY.

There are ills now, as there always have been. Land often bears an undue proportion of taxation, transportation rates are not always just, immigration keeps our economic conditions in a ferment, the tariff is unstable and not always helpful, there are combines which speculate upon farm produce, there is often great difficulty in reaching the consumer, the rural delivery of mails is not consummated, legislators play upon the prejudices of the farmer, railroads often have been developed at expense of highways; but the greatest ills are poor farming and poor farmers. Ride along any railroad or highway and point out the farm which is producing all that it might! How many farms are well farmed? One in ten? I fancy not one in a hundred.

How may a farmer farm better? High prices make shiftless farmers. High prices opened the West before its time. High prices robbed the land of its virgin strength and then run away. The crisis is now on, and it will not lift of itself nor by legislation. The remedy is evolution. Evolution is progress, and progress is possible only with education. The difficulties will vanish with the evolution of the farmer, by natural means and by social and legislative forces which he will set at work. They tell us that the farmer will be prosperous next year or in the coming administration, or under free trade or of protective tariff. Do not believe it! The tariff appeals to the purse; education appeals to the man! Evolution must be from within outwards, or from below upwards. It is futile to attempt any permanent evolution by working upon the evidences of an agricultural decline. We build nothing by beginning on top, except wells, and they are apt to bury us. It is the farmer which makes agriculture, and it is the farmer, therefore, with whom amelioration must begin.

The one salvation of agriculture, therefore, is education. By education I mean education, not the dispensing of facts. The mental stature, like the moral and the physical, is a creature of growth. We must give the man broad and generous principles which make him a man, whether it makes him a farmer or not. It is better for him to know how and why a clod holds its moisture than to know whole systems of irrigation. It is more profitable for him to know why we till than to know all the dates and methods and tools for all the crops. Give a man principles,

and he will apply them for himself. Give a man a place to stand, and he will move the world. Facts are trivial as facts. They do not open the eyes of the blind, nor kindle the soul with enthusiasm. We are slaves to facts. Wake a man up. Shake out localisms and prejudices. Inspire him. Set him at work. Send him on his mission with joy.

I would not make a man a farmer. We have too many perfunctory farmers now. But I would take a man from the farm and educate him. The man must follow his genius. Time will sift and settle the vocations of men. I would love to educate my man in an agricultural college for thereby I should hope that he would develop a sympathetic attitude towards agriculture. We count with pride the graduates of our agricultural colleges who are farmers. I am thankful, also, for those who are not! Men are more than farmers!

Will the farmer educate himself? He must! Those who will not, will drop behind in the conflict. Not every farmer's boy is made of stuff that fits him to grasp a liberal education. Perhaps ten per cent is all that we can hope to reach now. We do not make rails from pepperidge or basswood!

We can hope something from the present farmers, but much more from the coming generation. We must begin with the children, where ideas are plastic, and prejudices are unformed, and then open the little minds to nature and to truth. We cannot teach agriculture in the primary schools any more than we can teach law or medicine; but we can teach the child to see and to infer. He can understand a flower, he can see the bee as it sips the nectar and then hums away, full of the riotous joy of living; he can know why the farmer rolls his wheat (which is more than the farmer knows), he can see the flight of the bird and catch a song which will lie in his memory forever.

The rennaisance of agriculture cannot come in a day. From Adam until the past generation, there has not been a school to teach agriculture. Untaught for centuries, can the farmer work a revolution in a lifetime? If he will not come to us, we must go to him. Our work is a mission; and like all missions, its success is measured by the wisdom and the sympathy of the missionary. By itinerary schools, readable bulletins and books, correspondence instruction, personal help, we can reach half the farmers, and this half will fertilize the other. I can see the new day coming in this grand old State, where, one day, there will be a host like an empire. I can hear the refrain from the old hills of New York, where, within a six-month, there have been reached for the betterment of agriculture 1,600 young farmers, 10,000 teachers and 25,000 children!

We need not farmers so much as we need men. Educate liberally all men and women who are fitted to receive, and educate nature-ward all those who live in the country or who have rural tastes. Teach that all men, whatever their vocation, are what their intellectual and moral stature make them to be. Teach that our civilization is a self-supporting organism in which every trade and profession lives because it is needed and because it deserves to live. Then I have no fear for agriculture.

STATE GRANGE.

ANNUAL MEETING DECEMBER 8-11, 1896.

[Abstract of report by the secretary, Miss Jennie Buell, June 30, 1897.]

The subordinate Granges of Michigan have heartily co-operated with the State Grange in all its projects for advancing organization among people of the rural districts. At the last annual meeting, in December, 1896, twenty Granges were reported as having been added to the working force of the order in the State and several others have been revived or planted since that date.

A marked feature of the year is the discontinuance of the Grange Visitor, which for twenty-two years had been the organ of the Granges of Michigan. In its place a Grange department in the Michigan Farmer is edited by K. L. Butterfield, the Visitor's last editor.

The Grange Fresh Air work has been continued under the energetic supervision of the Woman's Work Committee. Three hundred seventy-five children and mothers from the heated districts of the cities have been given from two to four weeks' vacation in country homes.

Patrons have attended and participated in all the Farmers' Institutes held in the State. They recognize the immense educational advantages involved in the increased appropriation for this purpose and bring to the Institutes their own experience and training in an order thoroughly equipped for effective organization.

Subordonate Granges have shown their appreciation of the Traveling Libraries by eager applications, and use of them when received.

Co-operative trade contracts are now made with reliable dealers in nearly all kinds of goods, implements and wares. This line of Grange activity is one that has long been practically dormant in this State but is now a promising feature.

The last session of the State Grange was much occupied with legislative questions, as is commonly the case on the year preceding the convening of the legislature. The executive committee was directed to select from the measures considered a limited number and especially press their claims. Accordingly the executive committee selected certain measures as being in the interests of farmers, and advised that they be presented to the legislature. Later in the session it seemed advisable to call out the support of the Grange on other questions. The bills known as the Anti-color, to Prevent appeals from Justice Courts where small amounts are involved, Traveling Library Appropriation, Farm Institute appropriation, and continuance of Tax Statistician, originated with the Grange and were petitioned for. Other measures petitioned for by the Grange and their passage urged, were the Kimmis county salary and the Wagar State official bills.

The bills presented in the legislature to repeal the mortgage tax law and to indirectly establish the township unit school system were successfully petitioned against by the Grange. It also strenuously opposed the repeal of the law providing for the collection of farm statistics and saw the bill defeated.

More than one-half of all the Granges in the State were represented on the Journals of the House and Senate during the legislative session as petitioning in respect to one or more of these measures.

The close times have been prosperously passed by Michigan Granges and they safely report "Progress."

ADDRESS OF MASTER, GEO. B. HORTON.

To the Representatives of the Order of the Patrons of Husbandry convened in State Grange:

Onward we are moving. Years seem but a day. Events great and small, joyous and sad, in fast succession crowd for our attention, and so absorb us that we little realize how time flies. Once more we meet in the interests of the order we love and revere, for the good it has done and is destined to do for the farmer and the agricultural interests of our country. We scarcely realize that another year has fled. How well we remember the earnestness and enthusiasm that characterized the last State Grange, and the renewed zeal with which the delegates departed for their respective homes, determined to be more devoted workers in the Grange vineyard. The deliberations of the State Grange should impress each and every delegate with the great importance of the order at large. They are here led to see and realize, as never before, the magnitude and grandness of its work. The new fires thus kindled should spread out to all parts of our State to warm and invigorate to extra effort the thousands who form our membership. Thus we see the great importance of our coming together. Sister and brother Patrons, the work and duties of this session are essentially yours to perform. With each succeeding year new responsibilities must be assumed, and your order must stand for more and more before the world. Thus you see that you cannot, altogether, pattern after the past. New and original thought and ideas are demanded.

The object of this communication is to give you a fair understanding of the best condition of the order throughout the State, to call your attention to questions of interest and regarding which the Grange has placed itself on record as favoring, and to make such general suggestions as may be helpful to this body in formulating the work of the session. To give each part that distinctiveness desirable to impress importance, separate headings are used.

GENERAL CONDITION.

Throughout the United States substantial growth has been made during the year just past. From every direction come reports of work well done. A spirit of unity prevails throughout our ranks, and never has faith in the order been more manifest.

There has been issued to Michigan during the year, twelve charters for absolutely new Granges and seven others as good as new have been established by the use of charters that had not been called in since these Granges ceased to work, some fifteen to twenty years ago. These added to dormant Granges that have gone to work again, after a brief inactive

condition, make a total of about twenty-five Granges added to our list. The report of membership dues paid to the National Grange in 1896 show an increase over 1895 of $72.82. This indicates an increase of 456 paying members during the same time.

FIELD WORK.

Immediately after the State Grange session of one year ago, specific plans were matured and in printed form placed in the hands of all county deputies for their guidance in the work of organizing and reorganizing. Also other specially prepared and printed matter was freely circulated for the use of officers and workers in existing Granges in their work of supporting and increasing membership. Farmers in attendance at Institutes were also canvassed for the purpose of locating neighborhoods favorable to Grange work. From this last source there is now on file much valuable data with which to commence the work anew. From personal experience, I am fully convinced that the printed recommendations as furnished each deputy will result in success in most cases, if confidently applied. For a test, seven localities were selected in Lenawee county, and today, strong, active, new Granges exist in every place, with three new Grange halls in process of building. The farmers are surely ready to accept of that helpful agency, organization, and it is not difficult for them to see that the Grange is the best equipped of all.

THE GRANGE VISITOR.

This old friend, which has served so good a purpose for so long, is to be no more after the close of the present year. In accordance with contract made, it is to be consolidated with the "Michigan Farmer" and the Grange relieved of its publication.

One of the saddest reflections regarding the "Visitor" is that it has, for several years, brought much other valuable work to a standstill. While the harvest has been ready for the sickle, it could not be gathered. If the ten thousand dollars that has gone to pay "Visitor" shortages had been judiciously used in the employment of skillful organizers and in carrying out plans for the encouragement and support of existing Granges, who can figure the result. This is from a purely business standpoint. Otherwise the "Visitor" has been of great benefit. As we say good-bye, old friend, let us remember it for the lasting good it has done.

THE MICHIGAN FARMER.

This ably conducted and widely circulated farm journal, which is soon to contain a comprehensive Grange Department, edited by our own esteemed Bro. K. L. Butterfield, is deserving of the support of every Patron family in Michigan.

WOMAN'S WORK IN THE GRANGE.

Where woman is interested and applies her energies, success follows. To thus interest her, give her something special to do, so that she will realize that she is a spoke in the Grange wheel. It is equally true that without her presence and continued assistance, no Grange would long

live. The work of education, social culture and entertainment, maintaining true fraternity and the spirit of charity, and compatible with her nature. In reiterating what has been said before, the Granges of the State are strongly urged to appoint a committee on woman's work at the beginning of the new year.

GOOD OF THE ORDER.

To the delegates here assembled and the membership in general, the things which may be suggested for the good of the order are of great interest and paramount importance. The order of the Patrons of Husbandry was brought into existence from a demand of the times. While its promoters saw the necessity of such an organization, and had an idea of what its specific lines of work should be, they knew not of its future. In the preamble to its constitution is laid down the general proposition which was intended to form a nucleus around which to build the primitive organization, and for this it was successful.

The necessity of the declaration of specific objects was soon made manifest, and at the seventh session of the National Grange the now famous Declaration of Principles was adopted and given to the world. With all this progress made, with all the crystallizing of thoughts that resulted in the promulgation of that document, it was not yet clear as to just how these objects so desirable and essential were to be attained. All was yet experimental. Serious obstacles were in the way. Methods, the results of many years' maturing, were to be changed. People with sameness of interests, though differing as to methods, were asked to work in harmony for their mutual good. The details for the accomplishment of this work were still unwritten and unsaid. Experience and time must demonstrate the way.

The great importance of making stronger a true fraternal feeling among our members cannot be urged too strongly. All should remember their obligations and the lessons taught in all our ritualistic forms. It will assist in carrying out the true principles of our order and of establishing that friendly, sympathetic and charitable feeling between fellow farmers that is so necessary in educating them to the point of acting more generally together, and without such acting together their influence can be but little.

TAXATION.

This becomes more and more an important question. It cannot be truthfully said that our State institutions exceed in number or purposes the wish of the people, nor that our State government is aiming too high, but under the present depressed conditions of productive industries the farmers, who are inclined to believe, and with just cause, that they pay more than a just proportion of the public expense, are uncommonly critical and are inquiring into these matters more than ever before. In doing this they are but exercising good business sagacity. Their investigations should go far enough to arrive at the true conditions, and then to the extent justice is done, insist that corrections be made.

OFFICIAL SALARIES.

Although injustice in tax levies as between people and interests add much to the burdens complained of by farmers, and their correction

would give substantial relief, they should not overlook those items of public expense which may reasonably increase the aggregate amount to be raised. Official salaries should be in accordance with the abilities required and the value of the work to be performed. Economy in management of all public institutions and legislative sessions. Also a judicious care over appropriations should be demanded. The large majority of taxpayers are forced to strict economy in all their affairs, and especially in the expenditure of money. Therefore extravagance in the management of any of the people's affairs should not go uncriticised.

For these reforms and to encourage that interest in public affairs which will make our people well informed therein, our order should use its strongest influence. No partisan bias should be permitted to deter our members from doing that which is right and in presenting a solid front in these requests.

PURE FOOD.

No work of the Grange is more gratifying than that put forth in the interest of having enacted laws for the protection of our honest food producers from unfair and disastrous competition and at the same time to assure the purchaser and consumer that he gets what he asks, desires and pays for, and further to permit the consumer who desires or prefers the cheap or adulterated articles to buy at their true value. The work in Michigan has but fairly commenced, and so valuable is it to both consumer and producer that the system can never be abolished, but instead, the laws will be perfected and their powers extended and the field of work for the Food Commissioner enlarged.

CO-OPERATION.

Although the term applies to every feature of Grange work, its consideration here has a more especial reference to co-operative trade. The farmer, to be successful, must reduce cost of production to a minimum, buy at the cheapest and sell at the highest prices obtainable.

In doing this he may consider and use the world as his market place. There is no law, moral or otherwise, in operation, to dictate that the farmer shall sell or buy only through prescribed channels. Moreover, it is a duty to investigate for himself and to act in accordance with the plan that will leave for him the best net results. The social standing of the farmer and his family depends upon his success in business. The amount and kind of schooling, books, clothing, advantages and opportunities that may be furnished depends upon the degree of success that follows his efforts measured in dollars.

SECRETARY OF AGRICULTURE.

One of the important movements formerly instituted at the National Grange was that to secure the appointment of Col. J. H. Brigham, master of the National Grange, to the position of Secretary of Agriculture, and as such, to a place in the President's cabinet. The elevation of the National Department of Agriculture so that its secretary may have a voice in the highest councils of the nation was first proposed and urged to final success by the Grange. This department, having in its keeping the general interests and wellfare of farmers, should be presided over

by a practical farmer, for none other can so fully see and sympathize with such measures proposed and to be presented as will assist this great and all-important interest.

AGRICULTURAL COLLEGE.

No general annual report to the State Grange would be complete if it did not call the attention of the delegates to the importance of this, the farmers' school. The State Board of Agriculture, from earnest desires and long experience, are striving, as I believe never before, to make this institution meet the true wants of the farmers of the State in supplying their sons and daughters with practical and helpful education. During the year several changes and some additions have been made to the courses of study and methods of procedure, each calculated to keep the College up to the demands of the times. The Granges of Michigan have been foremost in asking that suitable arrangements be made at the College to educate the young women as well as the young men. This request has been granted, and such a department is now a reality. That the members of this body may be fully informed regarding the ladies' department, and other changes that have been made during the year, and to the end that the information thus received may be communicated to all subordinate Granges of the State, I recommend that a special committee of ladies and gentlemen be appointed to visit the College and make report to this body before the close of this session. Special inquiry should be made regarding the short courses provided for the winter months. The farmers of Michigan should have renewed pride in this institution and support it as never before. Without doubt, it gives the best general and special training of any school in the State, for farm life. The short courses, to which allusion was made, are planned along very practical lines, and should be well patronized by all young men who desire to gain through the winter months a kind of information that will prove useful to them the following summer.

AGRICULTURE.

This subject is always of deepest interest to those whose profits from tilling the soil are to measure the advantages and opportunities they may enjoy. Agriculture comprises the business of farming in a broad and general way, and, as a whole, it cannot be truthfully said the general depressed conditions that have surrounded this the greatest of all our nation's interests for the past few years have changed for the better. The same dark clouds obscure its prospects, and farmers are forced to closer economy and to live within themselves the more. It is a severe trial for the farmer to reconcile himself to the seeming inevitable, that he must take a new inventory and therein scale down the value of his land and all its belongings fully one-half, and on that basis make a new start with practically his own hands. It is also a discouraging thought to entertain that although the wealth of the country has, during the last decade, increased in round numbers from sixteen to sixty-four billion of dollars, proportionately the share of the agriculturist has decreased from nearly one-half to less than one-fourth of the whole amount, and this while the mortgage indebtedness thereon has considerably increased and the embarrassment caused by such indebtedness has been

multiplied. It may be borne in mind that during the time this proportionate ownership of the property of the country has so materially shifted from one class of people to others that the number of those engaged in agricultural pursuits has proportionately increased with the growing population of the country. Whatever may be the causes that contribute to these conditions and tendencies, it needs no philosopher to see that the sure result will be to lower the social conditions and standing of the American farmer and to make the lines of distinction more prominent.

While the Grange is a non-partisan organization, and cannot as a body take action on partisan questions, it can and should, because of the identity of interests of all its members, educate and encourage toward that unison of thought and action on all questions of local, State and National policy as will make the influence of the agricultural people more potent for their general good.

THE DEPARTED.

Since last we met, death has removed from the labors of earth and the companionship of our fraternity two active members. Bro. Thomas F. Moore was from the inception of the Grange an able and earnest advocate of its principles. His voice has been heard in many Grange halls and from many public platforms throughout the State, championing the cause of improvement, higher aims and ambitions in life. The State Grange has at times honored him with official positions and he was always efficient and faithful. Bro. H. H. Dresser, an ex-member of the executive committee, was an ardent supporter of the order. For those sturdy and telling blows that bade opposition retreat, for the upbuilding of his cause, he had few equals. The present standing of the order in Michigan owes much to these sturdy pioneers in Grange work. We may well ask, who can fill their places?

CONCLUSION.

And now, Patrons, let us strengthen and renew our fealty and devotion to the order. It stands for grand principles. We can do no better than to defend and perpetuate it. Years of experience are now of great benefit. These, together with the devotion and ardent labors of that army of noble men and women who have labored so long and faithfully, must not go for naught. The degree of prosperity the order is to enjoy during the coming year, will very largely be measured by your work at this session. This fact should place fairly before you the importance of your coming.

For the past four years I have tried to be faithful to the best interests of the order. I have fully appreciated the honors bestowed upon me by being selected to fill the position of master of the State Grange, and at the same time have tried to keep in mind the important work of the office. The Patrons of Michigan have my most sincere thanks for the kindness they have at all times shown me and for their charitable considerations of my short comings, and now as I hand over the gavel to my successor, whom you will choose before the close of this session, I ask for him the same support you have always given me.

The chairman of the committee on legislative action submitted the following report:

Worthy Master, Sister and Brother Patrons:

Your committee on legislative action beg leave to present the following report for your consideration:

We desire to congratulate the Michigan State Grange on the successful enactment into law of the measures presented by its representatives to the legislature of 1895, to wit: The Farmers' Institute bill, the State Statistician bill, and the pure food bill.

The Farmers' Institute law, judging from the numerous press and private reports received from all over the State, is giving quite general satisfaction. There is now and then a locality where some changes of a local character can be made, that will bring the work contemplated by the law more nearly in touch with local sentiment. We have no doubt but that the good sense of those having the matter in charge will bring about the desirable changes, and that this law will long stand as a landmark, witnessing the wisdom of the order that was responsible for its enactment.

THE STATE STATISTICIAN

is one from which the farmers of the State are expecting very much. The officer charged with the duty of carrying out its provisions has not yet submitted his report, and the benefits which are hoped to be derived from his recommendations to the legislature are at present only conjectural. We believe, however, that much good will be accomplished, and are unreservedly in favor of the continuance of the office until such time as the people are satisfied that no more benefits may be derived from it.

THE PURE FOOD LAW

has passed beyond that period which may be considered as experimental. Its execution has resulted in the saving of very large amounts of money to consumers of food products. Before its enactment, Michigan was fast gaining an enviable notoriety as the grand dumping ground for all kinds of adulterated products. We are glad to be able to state that the efforts put forth by the officers charged with the execution of this law have practically driven from the State the unscrupulous business men whose prime motive was only gain, and given to the honest manufacturer a practical monopoly of the markets of Michigan.

It was not to be expected but that the putting in force of a new law of such vast importance would exhibit points of weakness in that law. Several of such have already been discovered, and the incoming legislature will be asked to remedy its defects. A new clause should be added prohibiting the coloring of butterine, oleomargarine, or other similar products, so as in any way to imitate pure butter. The right to enter any place of business for the purpose of detecting fraud should be given the commission, and also the right, under proper guarantees, to open packages suspected to contain adulterated products.

The committee presented the following resolutions, which were concurred in and adopted:

Resolved, That the work of the Tax Statistician has proved of sufficient importance and benefit to the taxpayers of the State to warrant the continuance of the office.

Resolved, That the incoming legislature be asked to continue the necessary appropriations for Farmers' Institutes.

A resolution relative to the non-establishment of more State institutions.

Resolved, That the Michigan prisons should be made self-suporting.

Resolved, That no change be made in our road laws whereby the maintenance of our roads shall be made more burdensome than at present, or that will dispossess the farming community of their management.

Resolved, That it is the sense of the Granges of Grand Traverse county that the Michigan State Grange use all honorable means to procure such legislation as will cause all State institutions to purchase within this State their beef, butter and such other supplies as are produced in the State.

A resolution relative to a uniform distribution of road tax and labor.

Resolved, That the tax for highway purposes be assessed and collected at the same time and in the same manner as other taxes of the township; be it further

Resolved, That persons subject to assessment for highway purposes may perform labor upon the highway, under the instruction of said township commissioner, to the amount of not less than 75 per cent of his highway tax, and to receive the commissioner's receipt for the same. Said receipt to be receivable by the township treasurer to apply on highway tax.

WHEREAS, We believe that the salaries of our county officers are too high, and that they are out of proportion to the prices of farm products and labor; therefore

Resolved, That all county officers should be salaried, and that these should be reduced to the lowest practical limit.

WHEREAS, We believe that the pure food law should be strengthened and enforced; therefore be it

Resolved, That we favor such amendments to the law as will give the Pure Food Commissioner power to enforce the same.

WHEREAS, Believing that a board of county auditors would result in the saving of many thousand dollars annually; therefore

Resolved, That the Michigan State Grange respectfully ask the legislature to take such action as will bring about this desired end.

WHEREAS, The farmers of Michigan have time and again placed themselves on record as favoring the rural free mail delivery system; therefore be it

Resolved, That we reaffirm our position and again ask our legislative body at Washington to enact such a law.

WHEREAS, It is a fact that but a small percentage of the taxpayers of the State know just how much is being paid for official services rendered; and

WHEREAS, We believe that many of our officials are receiving in fees and perquisites many times as much money as their salaries afford; therefore,

Resolved, That we ask the legislature to enact such laws as shall cause all salaried officers to keep strict account of all fees and perquisites received by them and to turn the same over to designated officers.

WHEREAS, The supply of traveling libraries has been utterly inadequate to the demand, at least two hundred more of these libraries being needed; therefore,

Resolved, That the legislature of 1897 be urged to appropriate the sum of $5,000 for the year, and also for the year 1898, in order that this great educational work may be successfully carried on.

Your committee, having had this matter under consideration, would recommend an appropriation of $2,500 for the year 1897 and the same amount for 1898 for said circulating library fund.

The following resolutions, offered by the committee on resolutions, were adopted:

Resolved, That the executive committee of this Grange appoint a committee of three to confer with the State Board of Agriculture, and with said board make arrangements whereby graduates from our rural schools may be admitted to said College without examination.

Resolved, That we reaffirm the resolutions passed at our last annual meeting relative to the compilation of the laws of the State, which resolutions were as follows:

Resolved, That we recommend the action of the last legislature in ordering a recompilation of the general laws of the State, together with citations and notes of the decisions of the Supreme Court thereon, as a wise step taken in the interests of the ten thousand public officers who are expected to enforce and observe the laws in their official capacity, but who do not have the time and legal training to enable them to search through and compare the contents of many volumes of laws and decisions;

Resolved, That we also commend the action of the legislature in returning to the wise policy of the State in preparing, publishing and owning its own compilation of the general laws, in accordance with the express terms of the constitution, as well calcualated to insure correctness in publication and saving of expense to the people;

Resolved, That we recommend that the next legislature, after the close of its own work, order the new compilation published as speedily as possible and consistent with correctness of execution, and provide for offering for sale, at the very lowest price possible, a sufficient number of copies to supply every citizen who desires them with the laws which he is expected to obey and the ignorance of which is no excuse for their violation.

Resolved, By the Michigan State Grange, that we consider the printing, binding and distribution of the Legislative Journals and joint documents beyond the number required for the legislators, State officers and State Library a useless expenditure of money. Therefore we request the incoming legislature to repeal the law which provides for the distribution of the Legislative Journal and joint documents among the counties of this State.

Resolved, That we desire to express our appreciation of the labors of the Michigan Association of Farmers' Clubs; to extend to them the hand of hearty co-operation in all that has for its object the advancement of the farmer and the betterment of his conditions. We believe that the Grange should at all times offer fraternal greeting to kindred organizations and by every means within its power to assist, encourage and develop farmers' organizations for co-operation and mutual benefit.

Resolved, That whereas, the Grange and the district school are so closely allied, as likewise is the Grange and the Agricultural College,

the relation between the rural school and the College should be more intimate, and as a means to that end we believe that if the State Board of Agriculture would furnish a limited number of framed photographic views of the College buildings, grounds, stock, etc., and said views were through our local committees on woman's work hung upon the bare walls of our country school houses, it would not only adorn and beautify the latter, but would be a direct and economical means of advertising for the College and bring about more rapidly than any present method adopted, a more intimate relation between school and College, be a means of increasing the attendance of more farmer's boys and girls at the College, and an inspiration for a further beautifying of the country school room.

Resolved, That we heartily approve of the management of the State Farmers' Institute; that while it is, perhaps, not perfect in detail, we firmly believe that the field work will show where improvements and changes can be made; we have full confidence in the present superintendent, Bro. Kenyon L. Butterfield, and believe that the system will be improved as rapidly as circumstances will permit. That we do not think it at all advisable to place it under any different board of control, but for many reasons desire it to remain as at present, under the control of the State Board of Agriculture. We also believe the State Farmers' Institute is accomplishing great good to the vast majority of our farming districts, and that it is rapidly increasing its scope of usefulness. That the best interests of the State demand its continuance, and a larger rather than a smaller appropriation should be made by our next legislature for its maintenance and enlarged educational influence.

STATE ASSOCIATION OF FARMERS' CLUBS.

FOURTH ANNUAL MEETING.

The Association met in the Senate Chamber at Lansing, Monday, December 7, 1896, President A. M. Kimmis in the chair.

On motion, a committee consisting of A. A. Wood of Saline, R. K. Devine of Holly and L. H. Ives of Mason was appointed to wait upon Governor Rich and escort him before the Association.

After making a few remarks welcoming the delegates to the capital, Governor Rich took up the topics which the Association expects to discuss.

The subject of prison labor and economy in the prisons was the first topic. Governor Rich showed his hearers that Michigan prisons have been more and more cheaply conducted year after year and that Jackson prison costs vastly less to the State than any other prison, and he attributes the fact to the contract labor system used there. On that, he said that in spite of the well known opposition of laboring men to the contract system, he believed the contract system to be the most equitable that can be adopted. As an illustration, he said that at one time when work was done in Jackson prison on State account, it cost more to keep the prisoners who were at work than to keep the criminal insane who did nothing. Governor Rich said that he was in favor of making Jackson prison a workshop, the Ionia prison a reformatory and the Marquette prison a prison for incorrigibles.

On the subject of the insane asylums Governor Rich said that the last year's expenses in running the asylums was $492,000. For the next two years he expects it will cost $1,200,000. He expressed himself as in favor of allowing large discretion to the boards in control of the management of asylums, but he thought that their power should be curtailed in some respects by the next legislature. He favored a liberal policy toward the University, but thought the regents ought to charge the foreign students enough so that their education should cost the State nothing. This sentiment was loudly applauded.

The present tax law, the Governor thought, was fair in the main, but he spoke at length on the wrong of allowing men on large salaries to have all the advantages of the State government, public schools and institutions without contributing to their support. The Governor condemned the periodical sale of lands taken by the State for taxes and

said that such sales since their inauguration had only netted the State $68,000. The Governor dwelt on the financial condition of the State, and said that for the running of the State government and institutions next year about $2,000,000 would have to be appropriated.

On the subject of new State institutions, he favored an institution for the care of girls discharged from the Adrian Industrial School and larger facilities for the care of the insane and feeble minded. The Marquette prison and the Mining School, he said, were both of them of doubtful value to the State at large, although he did not say that he would favor their abolition.

The Governor was listened to with marked attention, and after his address he remained to answer such questions as the members wished to ask him.

A response to the address of welcome was given by E. L. Lockwood of Petersburg. Mr. Lockwood emphasized particularly the fact suggested by Governor Rich that the Association must be broadminded in its deliberations, and that they had met together as business men to discuss affairs and conditions which were intensely practical.

The report of the secretary for the last annual meeting was then read and adopted.

The following committee appointments were then announced by President Kimmis:

Credentials—Messrs. Wood, Mitchell, Tooley, Wilcox and Smith.

Resolutions pertaining to legislation—Messrs. J. T. Daniells, Merrill, Jackson, Waches and Mann.

General resolutions—Messrs. Wells, Noble and King, and Mesdames Hazen and Leighton.

A motion prevailed to apply the receipts from club memberships at this meeting on the expenses of the coming year.

A motion to appoint a committee of conference with the State Grange, the president to be chairman, was carried. As such committee, in addition to himself, the chairman named Messrs. Bird, Daniells, Lockwood and Shepard.

An invitation was then extended to Mrs. Mayo of Battle Creek to address the convention. Mrs. Mayo responded. She urged upon the delegates the fact that the question of taxation interested women as well as men, for directly and indirectly the burden falls upon the women fully as much as upon the men. Her words of praise for the great work of women in the home, in the club and in the Grange were warmly received by every listener, and a hearty vote of thanks followed the address.

The session closed with the naming of a committee on amendments to constitution and by laws, consisting of Messrs. Ives, Hudson, Bird, Green and Peckham.

EVENING SESSION.

President Kimmis delivered the annual address, as follows:

ADDRESS OF PRESIDENT KIMMIS.

On the fourth day of February, 1894, delegates from about twenty-five farmers' clubs in the State of Michigan assembled in this chamber for the purpose of considering the advisability of forming a central or State organization. As a result of their deliberations, there came into existence an organization which challenged the attention of the people of Michigan and the fame of which has spread throughout the Union. From many states and different parts of Canada have come inquiries concerning the Michigan State Association of Farmers' Clubs, its methods and purposes. When five delegates retired to yonder room for the purpose of framing a constitution and by-laws for the proposed organization, they carried with them five more or less clearly defined but radically different opinions concerning the direction which should be given the new movement. The central idea was to secure a co-operation of the clubs of the State in an effort to benefit the farmer, but just what should be undertaken and the exact manner of procedure were questions concerning which there was not unity of opinion. The constitution, as finally reported to the convention, was broad enough to permit any line of effort that can be deemed of benefit to the farmer. Every delegate present discovered in its terms a provision that would allow him to press the particular policy he deemed most important. It declared as its purpose the uplifting of the farmer in social, moral, intellectual and financial condition. What effort for the accomplishment of good may not find sanction under such a declaration of purpose? In no one of the four fields, social, moral, intellectual, financial improvement, has the work of this Association been barren of results.

Recognizing the fact that the accomplishment of the first three, namely, social, moral, intellectual advancement, was the inevitable result of good local club work, the Association wisely turned its attention during the first year to the encouragement of local organization. The number of clubs in Michigan nearly quadrupled in the twelve months succeeding the establishment of the State Association, nor will any unprejudiced person deny this Association the credit of being the potent factor in accomplishing this wonderful result. Keeping the result in mind, contrast the condition of the members of your local clubs with their condition at the time of its organization; estimate, if possible, the value of the blessings that have come to them because of its influence, and ask them has the Association paid? If the organization of so large a number of local clubs, with all their attending benefits, is attributable to this Association, with what satisfaction may those who have labored so industriously in this cause contemplate the results thus far attained. If this Association had accomplished no more than has already been enumerated, it would have amply justified its right to exist. It has done more.

While the local club is potent in elevating the social, moral and intellectual conditions of its members, and thus indirectly conferring financial benefit, it could never hope to succeed in such an interference in public affairs as would result in a direct cash saving to the taxpayers. This the State Association has attempted, and it can point even now to results accomplished. While our constitution is broad enough to admit and justify effort in many fields, it has been the policy of this Association to determine, first, from which direction came the imperative demand for our effort and then to concentrate the power of the Association for the accomplishment of the desired results. Before the last annual meeting there was a general complaint that taxes were almost unendurably high. The protest was so vigorous and long continued that the executive committee of this Association decided that in no way could it render greater service to the people in general and farmers in particular than by an effort to reduce taxation. Accordingly the call for the last annual meeting was a suggestion that the Association should enter upon an inquiry as to how this result could be accomplished. The action of that committee was endorsed by the Association, and the work of the last annual meeting was devoted largely to an inquiry into the causes of our burdensome tax levy. The local clubs have, during the past year, continued this investigation. That the lines pursued by the local clubs have been parallel and their conclusions so nearly a unit, is due in a large measure to the efficient aid rendered the Association by our department in the "Michigan Farmer," which has been so ably and fearlessly conducted by our honored ex-president. Too much praise cannot be bestowed upon Mr. Bird for the service he has rendered this Association. As a result we are met in annual convention with clearly defined ideas concerning the specific changes which should be made in the conduct of public affairs, to the end that taxation may be reduced. This purpose of reducing taxation comes up as unfinished business and should have precedence in our deliberations. We shall now make public declaration of our conclusions and desires and determine the means which we shall adopt to secure a compliance with our demands.

Your executive committee has endorsed and recommend for your adoption eight succinct propositions relating to public affairs. They believe that the practical application of them would result in an annual saving to the taxpayers of more than half a million dollars. This declaration of principles is the outgrowth of the discussions of public matters which have been the prominent feature of associational and local club work. They are doubtless familiar to you, yet are of so great importance as to demand enumeration here. They are as follows:

First, That all county officials shall be paid in full for their respective services by stated salaries fixed by the respective boards of supervisors, and that it be made a criminal offense for such officials to receive any fees or other perquisites in addition to their salaries.

Further, that the fees collected in county offices be readjusted on an equitable basis, and that hereafter all such fees be turned into the county treasury and become a part of the general fund.

Second, That no new State institutions be established by the next legislature, and that there be a general weeding out of the unprofitable State institutions already in existence and of unbusiness-like methods of management wherever they exist.

Third, That Michigan prisons should in the aggregate be made self-supporting.

Fourth, That provision be made whereby the estates of the insane, or those parties legally responsible for their support, shall contribute either in full or in part, as the circumstances shall warrant, toward the maintenance of said insane when confined in the public asylums.

Fifth, That not more than the regular one-sixth mill tax be granted to the university for the coming two years.

Sixth, That no changes be made in our road laws whereby the maintenance of our roads shall be made more burdensome than at present.

Seventh, That a more economical and effective system for the collection of taxes upon non-resident land must be devised.

Eighth, That our tax system be so amended as to secure a more equitable distribution of the burdens of taxation upon both personal property and real estate, and upon both corporate and private capital.

Every thinking person admits that the accomplishment of some of the results therein set forth as desirable will require the best effort of the best intellect on the part of those who legislate, and if the progress seems to be slow, we should be patient so long as we are convinced that men of ability are honestly striving. Honesty of purpose, however, is not enough. We have a right to demand that those to whom we must look for the solution of these problems shall possess unswerving honesty and large ability. On the other hand, there are among these principles some which are easily to be accomplished. The simple publication of the facts bearing upon one of them, sustained in some instances by the influence of local clubs, has resulted in a direct cash saving in many counties aggregating more than $55,000. We may not succeed at once in accomplishing all we desire, but some measure of success already crowns our effort. Our progress in the immediate future depends in large measure upon how thoroughly the local clubs performed the work recommended at our last annual meeting in relation to nominations for legislative offices. At our last annual meeting the Association endorsed the action of the State in returning to the original plan of compiling and printing its own laws. Any other manner of procedure is believed to be contrary to the constitution of Michigan. If the State had never departed from the consttiutional method there would have been saved, at a very conservative estimate, at least $100,000 to the treasury, while the amount extorted from those who were compelled to own the compilation cannot be estimated, but must have been very large. There will doubtless be great influence brought to bear upon the next legislature to induce an abandonment of the wise plan now in process of execution. The completion of the good work will require affirmative action by the legislature. This matter is of great importance to the taxpayer, for its influence extends over a series of years, affecting not only the treasury of the State, but the pocket of every man who buys a copy of our laws. The importance of this matter grows upon one when he remembers that ignorance of the law excuses no one. A copy of them should be within easy reach of every person. For some years past the only way to secure a copy has been to pay an exorbitant price to a corporation or firm residing outside the State. The new plan, or rather the constitutional plan, is for the State to compile and print its own laws and supply its citizens at actual cost. The importance of this matter

justifies the recommendation that the Association reaffirm the resolution relating thereto which was passed at our last annual meeting.

The avowed policy of this Association is concentration and continuity of effort. A most important and well matured plan is in process of execution. How long it will require our undivided effort cannot at present be determined. Nothing, therefore, could be more inappropriate than to detract attention from the work in which we are now engaged by a presentation of the possibilities which lie before us. If this address seems lacking in that it presents no original plans and recommendations, be it remembered that we have business now on hand which admits of no division of effort.

When we shall have accomplished our present undertaking, we may properly enter other fields; not till then. The justification of reiterating and emphasizing the necessity of concentration is found in the history of all organized effort.

With the augmentation of power there comes, inevitably, a tendency to rush from one line of effort to another, an inclination to attempt many things, ofttimes unadvisedly. This Association cannot hope to claim exemption from these universal tendencies. They are centrifugal forces, disrupting in their effect, unless neutralized by their correlatives. Usually this correlative force is found in constitutional limitations, but our organization, as we have noticed, has no such limitations, hence our centripetal force must be found in the exercise of the most exacting conservatism. And such conservatism will, we believe, be exercised; not of the kind that induces men to supinely accept all existing conditions, but of the kind that shall secure the consideration of every policy, and shall demand that lines of effort shall be based upon carefully established facts instead of prejudice.

The successful individual must have definiteness of purpose. Labor is his balance wheel, and to secure a perfect equipoise enabling him to control the tendency to outbursts of natural inclination and passion, that labor must be continuous and free from mutability. So if history is to enroll our Association among the few successful philanthropic organizations, it must have a definite purpose; and continuity and immutability of effort must be its distinguishing features. I used the word "philanthropic" advisedly. True, this is the organization of a class, but the good which we seek is not of limited application. Not one declared purpose of this Association but would, if accomplished, inure to the benefit of every patriotic citizen of Michigan; and those only are objecting who are now, or who hope to be, the recipients of an unjust bounty. It is the absence of selfishness, the broad benevolence of our purposes, which entitles us to use the word "philanthropic" and has won the approbation of the public. We may well be proud that the good citizens everywhere, residents and non-residents of Michigan, all who understand our purposes, are anxious for the success of our Association. These considerations must impress every delegate with the responsibility of his position. The immediate future of this Association is absolutely in your hands, and all its future depends largely upon the action of this convention. Let us avoid extravagance of expression. If any delegate is harboring feelings other than those of broadest charity and benevolence for all mankind, let him keep them safely confined in his own breast. We must keep clear of entanglement of all questions which have become

partisan; we have to do with measures and with individuals, not parties. Should there be a disposition to dwarf this Association by committing it to the advocacy of measures which will be of benefit to the farmers alone, let it be remembered that selfishness is alike destructive of all that is best in the individual or the organization; that classism is of all evils most to be avoided, because it is unjust and because its most baneful influence is felt by those whom it purports to benefit. As in the past, so in the future, let us have none of it. Any other policy will surely alienate the sympathy which we now so richly enjoy.

The most critical period of the life of the individual is when he first becomes conscious of his power. As an association, we stand in that position today, and if we escape error and possible disaster, our motion must be regulated by the balance wheel of conservatism. If our work has thus far been largely experimental, it will be no less so in the future. In vain shall we look to the past for analogies to guide us, for in the rapid evolution of today past conditions, in ensemble, find no repetition.

The charge of having exceeded his authority in some matters may be truthfully brought against your presiding officer. His only justification is the fact that the results of such transgressions have been of undeniable benefit to the Association.

The difficulties attendant upon the present position of the Association are most fully appreciated by those who are giving most thought and are contributing most of time and energy for its success.

Our last annual meeting demonstrated the fact that this Association can harmoniously discuss questions of such nature as are likely to come before us for determination at this meeting. Your resolutions are but the expressions of your desires; much more important are the plans you make for the purpose of securing a compliance with those requests.

In the discharge of the duties which devolve upon the presiding officer, I shall doubtless receive the hearty co-operation in all efforts to maintain that temperance of discussion and courteous observance of individual rights which should characterize our deliberations. An abiding faith in the wisdom, earnestness and good sense of the delegates here assembled begets a confidence that in your final conclusions there will be found no evidence of that unseemly radicalism which is a hindrance rather than an aid to the equitable adjustment of affairs.

Mr. Woodbury of the Union Farmers' Club and Mr. Smith of the Grass Lake Club led in the discussion of the president's address.

Robert Gibbons of Detroit addressed the Association on "Effective Work with the Legislature." He urged the Association to concentrate their efforts on their work. Present only measures of merit, place the bills in the hands of reliable men and appoint men suitable to present the measures to the legislative committees. To go slow but sure, and thereby accomplish what they set out to do. He thought the legislature was oftentimes abused without cause, and told the Association nothing could be gained by smiting the hand they expected to assist them. Legislative bodies were only human. He scored the newspapers for unjust and unwarranted assaults on legislative bodies and said their reports too often brought down the wrath of the people on the members of the legislature, when if their work and the facts were properly set forth the results would be different.

A lively discussion followed this paper. Delegate Wixom said the farmers themselves are largely to blame because they do not receive more at the hands of the legislature. Their work should first be done at the primaries. No class of people could expect that their interests could be well guarded unless men were selected for that purpose. Wherever evil existed, there was a remedy that united action would bring about.

Mr. Lockwood of Monroe said the reason more farmers were not in the legislature was because they could not stand the expense. He averred it cost all a man got out of it to spend a winter in the legislature, to say nothing of the $500 or $600 it cost to make the canvass.

Another delegate said he thought the Association should guard against selfishness. The members should remember that they are citizens of the State, that it was a large commonwealth of varied interests. The Association should know its own mind before it urged any measures upon the legislature. When the members know what the farmers really wanted, and were united on, they would be glad to comply with any reasonable request.

Mrs. R. F. Johnston of Detroit read a paper on "Woman's Influence in Farmers' Organizations." She said in part, "There are many good reasons why women should share in the work, the responsibilities and the benefits of the club, and I have yet to hear a valid reason assigned why they should not. One of the best reasons for their presence is that the farmer's family—a little isolated commune, the one and only syndicate of which the farmer is the head—cannot afford to disintegrate socially. In the cities, husbands and wives go and come independent of each other. But on the farms, the social pleasures must, by the circumstances and conditions of farm life, be such as both can enjoy, for they must be shared together.

Perhaps woman's direct influence is not as great as that she exercises unconsciously; indeed, we know that it is often true that the power of personality is stronger, though much less in evidence, than the force of advice and precept through direct speech.

It seems to me that woman's influence in farmers' organizations is not so very different after all from her influence in the farmer's family. Just as she can create a cheerful, refined, elevating atmosphere in the home, so she can engender these qualities in the club. Her presence tends to make discussions moderate in tone and temperate in expression, and in those discussions she can lift her voice for truth and purity and right.

It is my firm belief, that though there is no doubt woman's influence in farmers' organizations is both valuable and beneficient, the real gist of the question runs the other way. The influence of the organizations upon woman is greater than woman's influence in the organization. I repeat, I believe woman needs the club more than the club needs her.

It does us all good to meet and mingle with our kind. To do so helps to establish a bond of human sympathy between individuals and makes the brotherhood of man something more than empty words. It breaks the monotony and enlivens the isolation of farm life.

Many of you know that I do not believe in public life for women, but I do regard it as every woman's duty to be interested in, and to the extent of her opportunities, be conversant with our great national questions. We shall never have social or moral purity until women know

more about public affairs. How can indifferent mothers bring up patriotic sons? Love of country is no masculine virtue. It belongs to men and women alike. The women of 1776, the women of 1861, were permeated with loyalty to country. Perhaps were some issue involving some great personal sacrifice before them, the women of 1896 would prove as patriotic and as loyal as the dames of the revolution and the civil war. But our country needs not the spasmodic exercise of patriotic devotion, but the steady and abiding interest of our mothers on the events and issues that are making the history of today. For it is a history-making epoch, as those will realize who live to look back upon it through the perspective of the next decade. Therefore, I say, women need these organizations, that they may hear about and help discuss these crucial topics of public welfare in which all men are, and all women ought to be, interested."

At the session on Tuesday morning Professor Thompson of the University of Michigan addressed the Association in defence of the University. Prof. Thompson urged that the Farmers' Club endorse special appropriations. Education in the professions, he urged, was a public need. In this respect, the State University was performing a work that no other institution did, a work necessary to the continued growth and development of the State in art, science and civilization. The personal interest of the farmers in the University, he said, was greater than that of any other class. Over forty per cent of the University students were children of farmers. The agricultural class was the great feeder of all the professions. Furthermore, the farmer had a peculiar interest in the welfare of the University. The farmer's educational facilities were the district school, and he was far more dependent upon the University for higher education than any other class of citizens.

The discussion of this paper was led by A. C. Bird of Highland, ex-president of the Association. He stated that he was a warm friend of the institution and fully appreciated the great work it is doing. The main question for the Association to consider was whether or not it could afford to recommend any appropriation in the face of the present condition of the farmer. He charged that there was a tacit agreement last session that if the legislature voted the one-sixth mill tax, the University would ask for no special appropriations for several years to come.

The fifth clause of the declaration of principles was then taken up and adopted by a unanimous vote, as follows: That not more than the regular one-sixth mill tax be granted the University for the coming two years.

On invitation of the Association, C. V. Deland, State Statistician, gave a short address on the subject of taxation.

The future of the Farmers' Club movement was presented by A. C. Bird, who predicted a steady, continuous growth for the movement.

The relation of the State Association to the "Michigan Farmer" was then discussed, the general expression being that the future work of the Association must be largely done through the "Farmer."

Tuesday afternoon the committee on constitution and by-laws reported the following amendments:

Constitution, Article IV. Changing the date of meeting to the second Tuesday in December.

Article V. Allowing all officers to be re-elected by a two-thirds vote.

Article VI. Extending the privilege of membership to any club without the State, all membership requiring the payment of a fee of one dollar, which should entitle to membership until the following annual meeting.

By-laws: Changes recommended to require delegates to present credentials before being regularly seated.

The recommendations of the committee were adopted with the exception of the one relating to Article V of the Constitution.

The report of the committee on general resolutions was next considered. The committee had reported favorably upon the following:

Resolved, That it is the opinion of the Association that much good may be done by the various local clubs securing copies of the proceedings of the various boards of supervisors of the State, and discussing them fully with a view to acquainting themselves with the business of the counties.

Resolved, That in consideration of the increasing numbers of farmers' clubs and of the importance of the work to be done, the State Association recommends some form of county organization.

Resolved, That the State Association recommend the establishment of a department in the "Michigan Farmer" similar to that devoted to the State Association, for the recommendation and discussion of such questions as are of interest to the ladies of the clubs.

These resolutions were adopted by the convention, and also another offered subsequently endorsing the traveling library system.

As was thoroughly realized from the beginning, the great interests of the convention centralized in the consideration of the report of the committee on resolutions pertaining to legislation. Through the chairman, J. T. Daniells, this committee had reported in substance as follows: That they thoroughly approved of the entire eight principles recommended by the executive committee, but that in order that the work of the Association might be more effective, they recommended that the first, fifth, sixth and eighth be adopted by the convention.

DECLARATIONS OF PRINCIPLES.

First, That all county officials be paid in full for their respective services by stated salaries fixed by the respective boards of supervisors; and that it be made a criminal offense for such officials to receive any fees or other perquisites in addition to their salaries. Further, that the fees collected in county offices be readjusted on an equitable basis, and that hereafter all such fees be turned into the county treasury and become a part of the general fund.

Second, That no new State institutions be established by the next legislature, and that there be a general weeding out of the unprofitable State institutions already in existence, and of unbusiness-like methods of management wherever they exist.

Third, That Michigan prisons should, in the aggregate, be made self-supporting.

Fourth, That no more than the regular one-sixth mill tax be granted to the University for the coming two years.

Fifth, That no change be made in our road laws whereby the maintenance of our roads shall be made more burdensome than at present, or that will dispossess the farming community of their management.

Sixth, That a more economical and effective system of collecting taxes upon non-resident land must be devised.

Seventh, That our tax system be so amended as to secure a more equitable distribution of the burdens of taxation upon both personal property and real estate, and upon both corporate and private capital.

Eighth, That we reaffirm the resolutions passed at our last annual meeting relative to the compilation of the laws of the State, which resolutions were as follows:

Resolved, That we commend the action of the last legislature in ordering a recompilation of the general laws of the State, together with citations and notes of the decisions of the Supreme Court thereon, as a wise step taken in the interests of the ten thousand public officers who are expected to enforce and observe the laws in their official capacity, but who do not have the time and legal training necessary to enable them to search through and compare the contents of many volumes of laws and decisions.

Resolved, That we also commend the action of the legislature in returning to the wise policy of the State in preparing, publishing and owning its own compilation of the general laws, in accordance with the express terms of the constitution, as well calculated to insure correctness in publication and saving of expense to the public.

Resolved, That we recommend that the next legislature, after the close of its own work, order the new compilation published as speedily as possible and consistent with correctness of execution, and provide for offering for sale at the very lowest price possible a sufficient number of copies to supply every citizen who desires them with the law which he is expected to obey and the ignorance of which is no excuse for their violation.

Another resolution, offered by Hon. Patrick Hankerd, was afterwards adopted, asking the legislature to enact a law in the interest of economy in court procedure, providing that in civil cases a jury shall consist of six instead of twelve members.

A formal invitation from the State Grange, which was then in session at the other end of the Capitol, to meet with them in joint session in the evening, was at this point accepted and arrangements made to attend the meeting in a body.

The election of officers for the ensuing year resulted as follows: President, J. D. Daniells of Union Home; vice president, Patrick Hankerd of Henrietta; secretary and treasurer, F. D. Wells of Rochester; directors for three years, F. Whelan, North Newberg, A. L. Landon, Springport, and as director to fill the vacancy caused by the resignation of J. T. Daniells on his election to the presidency, L. H. Ives of Mason was elected.

President Kimmis then announced as the legislative committe for the coming year, H. D. Platt of Ypsilanti, Robert Gibbons of Detroit, A. C. Bird of Highland, F. C. Ruggles of Milford, and A. I. Barber of Mason.

Adjourned.

MISCELLANEOUS ARTICLES.

CO-OPERATION IN FRUIT SELLING.

BY HON. R. D. GRAHAM.

The Grand Rapids Fruitgrowers Association was organized about three years ago. There had long been felt the need for some united action on the part of the fruitgrowers of this vicinity for the purpose, chiefly, of advertising our fruit, and with no very definite idea of what we could do or, indeed, of what we wanted to do, a meeting was called and largely attended by the farmers and fruitgrowers, and out of that, although I believe it was in the following year our organization sprung. Of course there were nearly as many ideas as there were men present. Some advocated a strong legal organization, incorporating under the laws of the State; but this step was too radical for the conservative element, and we finally agreed upon our present plan, leaving every member perfectly free to do as he sees fit with his fruit, both as to packing and selling; in fact the association has no control whatever over any member or his product, it only acts as a moral support. First, every member is required to give in an estimate of his probable crop, the quality, time of ripening, etc. With this data the secretary of the association, after having procured from the railroad and express companies a complete list of freight and express rates to cities where we are likely to ship, with probable time in transit of fruit, gets out a circular setting forth these facts with such inducements and embelishments as may seem proper, mailing them to a large number of dealers all over the country, advising them to come to our market and purchase fruit direct from the grower. During the fruit season we have maintained a central office of sufficient dimensions to allow outside buyers an opportunity to store (temporarily) and pack their fruit. We have also at such place kept for sale fruit packages and covers, with every convenience for packing. By this means only have we been able to induce outside buyers to purchase direct from the grower, which is a matter of great importance. I said the association was a moral support. By this I mean, for instance, if the market is dull and buyers are bearing, reporting outside markets flat, etc., our secretary or business manager, who is always to be found on the market or at his office, is supposed to have the latest telegraphic reports, which may not and often do not confirm the statements of buyers, and then the grower always knows that if he does not

sell or, to use a common expression, "gets stuck" with his load, he can always ship on his own account with good prospects of winning. He has a place to go, with facilities for packing, etc. We have also used our association as a purchasing agent with good results, but this is in my opinion of very minor importance compared with the benefits secured by united action regarding railroad rates, time and facilities. I am also confident that our system of bringing the buyer direct to our market is the proper way to handle fruit. It does away with overcrowding and consequent glutting; each buyer takes what he thinks his house can handle profitably and of such grade or quality as best suits his particular trade, and in this respect alone there is a great difference. Some towns, even large ones, have never yet been known to give satisfactory prices for fine selected fruit, but will take a very large amount of common stock at fair prices, while others will take little or nothing but the best; and with buyers on the ground who know the wants of their trade, the very best results are obtained. I am forced to say, however, that our society has not given entire satisfaction. The growers as a class have not given it the hearty support which it merits, many of them saying, "O, I get just the same benefit as though I belonged and paid my dollar a year;" and they do, but this is not encouraging for those who do pay or those who are putting in their time and energy free of charge. Our association has already done us much good and our work is just begun. I have faith to believe that it will eventually receive the support of all the intelligent growers in this vicinity.

Grand Rapids, Dec. 16, 1896.

FARMING IN MENOMINEE COUNTY, MICHIGAN.

PREPARED BY MAGNUS NELSON, MENOMINEE, MICHIGAN.

In Menominee county we have nearly all kinds of soil. Along the west shore of Green Bay, and for perhaps a mile and a half back from the water, the soil is generally sandy, with a surface soil of black loam from 2 to 4 inches deep. Farther back from the lake the soil is mostly clay with a good hardpan sub-soil; here is also a good mixture of loam. The land originally was nearly all covered with timber. On what we call the "high lands" we have still maple, elm and basswood. In my judgment, this kind of land composes about one-third of the county, the other two-thirds being what we call "cedar swamps." There is also a slight mixture of tamarack, hemlock, white pine, balsam and spruce. During the great fire of 1871 a large portion of the county was burned over, and the lands not now cleared are covered with birch, popple, and a few soft maples.

So far as I know, the first settlement in the county was at a place called Bench Creek, located about seven miles north of the city of Menominee, and settled about 55 years ago. The people are mostly Germans, and their principal reliance is on potatoes and hay. Some of the younger people are now getting into control and are going into stock raising and dairying. There will soon be a butter factory in this section. Perhaps the most important farm community in this county is Stephenson, a little village about 20 miles north of the city of Menominee, which

was settled some 23 years ago. The farmers are largely younger people, quite largely foreigners from several nationalities; they started poor, but are fairly educated, and most of them now have nice farms. Up to this time most of these farmers have had timber to sell, and have relied on this for ready money, but the timber is getting scarce and, more especially since we have had our Farmers' Institutes, dairying is being quite largely introduced. A butter factory recently started paid the first summer for the cream 80 cents per hundred pounds of milk and the skimmed milk returned.

The county is quite rapidly settling up, and very few sections but contain farmers. We have some large farms, several having over 1,000 acres each under the plow. Still I think that not over 5 per cent of our available land is under cultivation, and, as a matter of fact, these lands are really our poorest. At one time the so called "high lands" were considered the best. I think this was largely due to the fact that the burning deposited large amounts of ashes, which enabled the new ground to produce exceedingly good crops. There is no question in my mind but what our cedar swamps are our best land. Of course there is great difficulty and expense in clearing these lands, but when once got under cultivation their fertility is almost inexhaustible. However, the art of clearing such land is not understood by most of our people. The general practice is to burn the land when it is very dry, thus getting what is termed "a good burn," but in doing this the splendid deposit of surface soil, consisting of partly decayed vegetable matter, is burned off. The better way is to wait for a good rain, after the land is once ready to burn, and when the brush is dry but the water still standing in the hollows, set the fire. But it will not get "a good burn," and it will generally cost $5 to $10 per acre to do the second burning; but I believe that if we can save from three to six inches of this top soil, amounting to several hundred loads per acre, we can well afford to put in the extra expense. Our swamp lands have mostly a clay sub-soil, or gravelly mixture, with a deposit of muck from six inches to three feet deep.

There is another difficulty in getting these swamp lands cleared, and that is in the present drain law. I think we ought to have an amendment that will give us the right, under proper restrictions, to drain through our neighbor's land to a natural outlet. They have such a law in Sweden which goes even farther, for after the drain is made through the neighbor's land he has to keep it in repair, under penalty for damages resulting from his neglect. Perhaps if we sent more farmers to the legislature we would have some of these things remedied.

Perhaps it may interest some of your readers to know something about my own work, not because I wish to boast of what I have done, but to show that any man with the right kind of energy can make a good success of farming in this county. I came from a good farming country in Sweden; in fact, I was sure that anything I did not know about farming was not worth knowing. After arriving in this country, for six years I worked in the mills, saving my money, and thus bought the land that I now farm. My first three years of farming were a failure so far as money making was concerned, but I got in the habit of reading agricultural papers and, together with my unsuccessful experiences, made up my mind that I did not know everything about farming. Ever since this I

have been willing to learn, and have found farm papers my best friends. I have found it essential to keep books, so as to know what crops paid me and what did not.

After 20 odd years of farming, I have now a dairy of 40 cows. Eleven years ago these cows averaged 4,500 pounds of milk per year; last year my herd gave an average of 6,800 pounds of milk per cow, including heifers. If I live eleven years more I expect to have them up to 9,000 or 10,000 pounds. I have 80 acres of land cleared, on which are 1,000 fruit trees and a garden containing 10 acres; 5 acres are occupied with 17 buildings and a yard; I grow 5 acres of strawberries and 3 acres of potatoes; this, with the roads, makes 26 acres, leaving me 54 acres for growing fodder crops. Since building my three silos I have raised on these 54 acres all the coarse fodder that I need for 51 head of cattle and 6 horses. I have no better land than the average in Menominee county; have worked hard, and have tried to benefit by the experience of others, as well as my own.

There is one thing more that I want to speak about, because so many farmers neglect it, and that is keeping accurate accounts. Most farmers that I know work on one year after another, keeping no account of what it has cost them to run their farms, and consequently they cannot tell which crops pay them. I have a separate account for each field, and when I find that one crop doesn't pay I raise something else. I charge the value of my labor to the farm and interest on my capital invested, and credit all improvements. I also have separate accounts for the dairy and for the farm. All fodder taken from the farm is charged, at market price, to the dairy and credited to the farm. During the past four years I have reduced over one-sixth the cost of keeping each cow. I find that farming pays, but am sure that it means just as much hard work and business skill as it does to succeed in anything else.

STATE HORTICULTURAL SOCIETY.

The twenty-sixth annual meeting of the State Horticultural Society was held in the Kent county court house, Grand Rapids, Tuesday, Wednesday, and Thursday, December 1, 2, and 3, beginning the morning of the first. It was held in conjunction with the West Michigan Fruitgrowers' Society, the G. R. V. Horticultural Society, the Grand Rapids Fruitgrowers' Association, and the Grand Rapids Florists' Club.

The program, except a few additions, embraced the following papers from the eminent specialists and leading growers named.

"Relative Hardiness of the Fruit Buds of Peaches and Plums," and "Remarks upon the Pollination of Fruits," Prof. John Craig of the Canadian experimental farm at Ottawa.

"The Future of Peach Growing in the United States," J. H. Hale of Connecticut.

"Recent work Among our Insect Enemies," Prof. M. V. Slingerland, entomologist at Cornell University.

"Education of Horticulturists," Prof. L. R. Taft of Michigan Agricultural College.

"Cultural Requisites for Best Development of some of our Garden Vegetables," Prof. W. W. Tracy of Detroit.

"Some Florists' Problems," Thomas Gunson, florist at Michigan Agricultural College.

"Object and Limitations of Pruning," R. M. Kellogg of Three Rivers.

"Observations and Experience in the Orchards the Past Summer," J. J. Gee of Whitehall.

"Fruit-Growing up to Date," W. W. Rork of Agnew.

"Celery-Growing for the Amateur," Edwin H. Starr of Royal Oak.

"Present and Future of Apple Culture," R. H. Sherwood of Watervliet and S. B. Smith of Grand Rapids.

President Morrill presented his system of pruning peach trees, the same being illustrated by means of the stereopticon, the pictures being from photographs of Mr. Morrill's trees.

The same instrument was used for the illustration of the addresses of Profs. Slingerland and Craig.

The subject of "Fruit Distribution" was treated by Mr. G. W. Barnett of Chicago.

An address of welcome was made by Hon. Chas. W. Garfield, whose remarks partook largely of a retrospective character, treating of the men and measures which have conduced to the society's success.

Besides the subjects represented by the papers, many other questions of interest and practical value were brought up by questions.

In order to encourage the exhibit of fruits, flowers and vegetables, the following prizes were offered:

For a collection of the best grown and most valuable fruits, of the various classes and varieties, strictly for market, special adaptation to such purpose to rule. Premiums—First, $5; second, $3; third, $2.

For a collection of the best grown and most desirable fruits of the various classes and varieties, adapted strictly to dessert and culinary uses, quality to rule. Premiums—First, $5; second, $3; third, $2.

For the most complete, best grown, and neatly arranged collection of kitchen and table garden vegetables, including potatoes; quality, adaptation to the purpose, and tasteful arrangement to rule. Premiums—First, $5; second, $3; third, $2.

For the most complete, well grown, and tastefully displayed collection of ornamental plants and cut flowers. Premiums—First, $5; second, $3; third, $2.

For the largest and best display of chrysanthemums in pots, $5; for the largest and best display of same as cut flowers, $3.

For largest and best display of cut roses. First premium, $5; second, $3.

For largest and best display of carnations. First premium, $3; second, $2.

MICHIGAN STATE AGRICULTURAL SOCIETY.

REPORT OF THE TRANSACTIONS OF THE SOCIETY FOR THE YEAR 1896, AND PROCEEDINGS OF THE WINTER MEETING OF THE EXECUTIVE COMMITTEE, JANUARY, 1897.

OFFICERS FOR 1896.

PRESIDENT—WILLIAN BALL, Hamburg.
VICE PRESIDENT—I. H. BUTTERFIELD, Lansing.
TREASURER—C. W. YOUNG, Paw Paw.
SECRETARY—HENRY S. FRALICK, Grand Rapids.

EXECUTIVE COMMITTEE.

TERM ENDING JAN'Y, 1897.

EUGENE FIFIELD	Bay City, Bay County.
L. B. TOWNSEND	Ionia, Ionia County.
F. H. LATTA	Battle Creek, Calhoun County.
L. W. BARNES	Byron, Shiawassee County.
W. P. CUSTARD	Mendon, St. Joseph County.
M. P. ANDERSON	Midland, Midland County.
C. E. LOCKWOOD	Washington, Macomb County.
W. E. BOYDEN	Delhi Mills, Washtenaw County.
E. W. COTTREL	Detroit, Wayne County.
H. D. CUTTING	Tecumseh, Lenawee County.

TERM ENDING JAN'Y, 1898.

E. W. HARDY	Osceola C't'r, Livingston County.
FRANK MAYNARD	Jackson, Jackson County.
F. L. REED	Olivet, Eaton County.
N. J. KELSEY	W. Le Roy, Calhoun County.
H. R. DEWEY	Grand Blanc, Genesee County.
JOHN LESSITER	Cole, Oakland County.
H. H. HINDS	Stanton, Montcalm County.
R. D. GRAHAM	Grand Rapids, Kent County.
F. E. SKEELS	Grand Rapids, Kent County.
M. J. GARD	Volinia, Cass County.

EX-PRESIDENTS.

CHARLES KIPP	St. Johns, Clinton County.
E. O. HUMPHREY	Kalamazoo, Kalamazoo County.
W. L. WEBBER	East Saginaw, Saginaw County.
GEO. W. PHILLIPS	Romeo, Macomb County.
WM. CHAMBERLAIN	Three Oaks, Berrien County.
A. O. HYDE	Marshall, Calhoun County.
T. W. PALMER	Detroit, Wayne County.
JAMES M. TURNER	Lansing, Ingham County.

STANDING COMMITTEES AND EXECUTIVE SUPERINTENDENTS.

BUSINESS COMMITTEE.

H. H. HINDS, EUGENE FIFIELD, H. S. FRALICK.

TRANSPORTATION COMMITTEE.

EUGENE FIFIELD, H. H. HINDS, SECRETARY.

RECEPTION COMMITTEE.

A. O. HYDE, WM. CHAMBERLAIN.

FINANCE COMMITTEE.

W. P. CUSTARD, M. P. ANDERSON, H. R. DEWEY.

PREMIUM LIST COMMITTEE.

EUGENE FIFIELD, L. W. BARNES, F. L. REED, JOHN LESSITER, C. E. LOCKWOOD, F. MAYNARD, R. D. GRAHAM.

COMMITTEE ON RULES.

W. E. BOYDEN, E. W. HARDY, M. P. ANDERSON.

PROGRAM COMMITTEE.

C. W. YOUNG, W. E. BOYDEN, AND SECRETARY.

PRINTING AND ADVERTISING COMMITTEE.

I. H. BUTTERFIELD, EUGENE FIFIELD, H. H. HINDS.

GENERAL SUPERINTENDENT.

H. H. HINDS.

CHIEF MARSHAL.

EUGENE FIFIELD.

EXECUTIVE COMMITTEE.

Cattle—W. E. Boyden.

Horses, Roadsters, Classes 12-16 and Speed Classes—Eugene Fifield.

Horses, Draft and Ponies, Classes 16-23—C. E. Lockwood.

Sheep—John Lessiter.

Swine—L. W. Barnes.

Poultry—E. W. Hardy.

Dairy, Bees and Honey—M. J. Gard.

Farm and Garden Products—F. L. Reed

Manufactured Goods, Music and Art—M. P. Anderson.

Vehicles—H. R. Dewey.

Needle Work and Childrens' Work—H. D. Cutting.

Miscellaneous and Special Exhibits, except special on fruits—Frank Maynard.

Horticulture—R. D. Graham.

Gates—F. H. Latta.

Police—N. J. Kelsey.

Forage—W. E. Boyden.

Machinery—F. E. Skeels.

Agricultural Implements—W. P. Custard.

REPORT OF THE JUDGES OF ELECTION FOR THE OFFICERS OF THE ASSOCIATION, HELD ON FAIR GROUNDS AT GRAND RAPIDS.

THURSDAY, SEPTEMBER 10, 1896.

Geo. W. Stewart, Grand Blanc; A. A. Wood, Saline; and E. N. Ball, Hamburg, duly appointed judges of election for the officers of the State Agricultural Society, held on the fair grounds at Grand Rapids, Thursday, September 10, 1896, do submit the following report.

Total number of ballots cast, 30, with the following result:

For President—William Ball	30
" Vice President—I. H. Butterfield	30
" Treasurer—C. W. Young	30
" Secretary—H. S. Fralick	30

FOR MEMBERS OF EXECUTIVE COMMITTEE.

Term ending January, 1899.

Eugene Fifield	30
L. G. Townsend	30
F. H. Latta	30
A. H. Zenner	30
L. W. Barnes	30
W. P. Custard	30
H. D. Cutting	30
M. P. Anderson	30
C. E. Lockwood	30
W. E. Boyden	30

PROCEEDINGS OF EXECUTIVE COMMITTEE, ANNUAL WINTER MEETING, 1896.

The annual meeting of the committee was called as provided in the constitution, to meet at the Hudson House, Lansing, Monday evening, January 11, 1897, at 8:00 p. m.

There were present, Wm. Ball, H. H. Hinds, Eugene Fifield, C. W. Young and I. H. Butterfield. A quorum not being present, on motion the meeting was adjourned to Wednesday evening, February 24, 1897, at 8:00 p. m., at the same place.

WEDNESDAY EVENING, FEBRUARY 24, 1897.

The committee met as per adjournment noted above at the Hudson House, Lansing, at 8:00 p. m. Meeting called to order by the president.

There were present the following members: Messrs. Barnes, Boyden, Butterfield, Cutting, Chamberlain, Dewey, Fifield, Graham, Gard, Hyde, Hinds, Hardy, Kelsey, Lockwood, Latta, Lessiter, Reed, Skeels, Young.

On motion of Mr. Lockwood, the regular order of business was deferred to listen to a committee from Detroit. Pending the appearance of the committee, Mr. G. A. Watkins of Detroit addressed the committee in advocacy of increased premiums for Shetland ponies. On motion, the matter was referred to committee on premium list.

The committee from Detroit, consisting of Messrs. Zenner, Swartz, Carr, Traver, Carmichael, and Gibbons, presented a proposition for holding the fair at Detroit for the next two years, followed by remarks by the various members explanatory of the proposition submitted. It was moved by Mr. Zenner that the matter be considered in committee of the whole. Mr. Hinds moved as an amendment that a committee be appointed to confer with Detroit committee.

On motion of Mr. Boyden, the motion and amendment were laid on the table.

On motion of Mr. Graham, a committee of five was appointed to consider the matter of holding the next fair.

On motion, adjourned to meet at 9:00 a. m. Thursday.

THURSDAY, FEBRUARY 25, 1897, 9:00 A. M.

Committee called to order by the president. Roll called, quorum present.

The secretary presented his report, which was accepted and referred to the finance committee. Report was as follows:

To the President and Executive Committee of the Michigan State Agricultural Society:

Gentlemen—I respectfully submit the following report from the secretary's office for the year 1896:

Receipts by Secretary, 1896.

Cash from J. H. Steiner, suspensions 1895	$31 50
Cash from memberships sold	473 00
Cash from stall rent	182 50
Cash from entries, trotting races	1,615 00
Total	$2,302 00
Paid C. W. Young cash as per receipts	2,302 00

The treasurer presented his report, which was accepted and referred to the finance committee. Report was as follows:

To the President and Members of the Executive Committee of the Michigan State Agricultural Society:

Gentlemen—I herewith submit the following as my report as treasurer for the year 1896:

Cash on hand February 4, 1896	$204 26	
General admissions	11,027 25	
Grand stand	1,147 50	
Secretary	2,302 00	
Privileges	1,714 60	
Speed	1,355 00	
Police	5 60	
Stalls	29 00	
Memberships	20 00	
Fines	5 00	
Note	1,005 51	
Board of trade	1,905 48	
Former secretary	244 72	
Business committee	531 65	
Refunded premiums	21 80	
		$21,519 37

DISBURSEMENTS.

Business orders, 1896	$12,569 09	
Premium orders, 1896	7,996 25	
Orders, former years	771 85	
Cash on hand, February 24, 1897	182 18	
		$21,519 37

Respectfully submitted,

C. W. YOUNG,
Treasurer.

The business committee presented the following report, which was referred to the finance committee:

Business Committee.

1896.		No of order.			
Feb.	13	301	John Lessiter, personal expenses	$12 00	
"	13	303	H. H. Hinds, personal expenses	100 01	
May	18	305	H. H. Hinds, personal expenses	90 00	
"	18	1	Eugene Fifield, personal expenses	20 60	
Aug.	4	10	Eugene Fifield, personal expenses	40 62	
Sept.	1	15	H. H. Hinds, personal expenses	81 75	
"	1	16	Eugene Fifield, personal expenses	45 98	
"	12	62	Eugene Fifield, personal expenses	45 13	
"	11	63	H. H. Hinds, personal expenses	6 75	
"	12	70	H. H. Hinds, personal expenses	67 50	
"	22	133	Eugene Fifield, personal expenses	12 75	
Oct.	3	143	Eugene Fifield, personal expenses	10 48	
"	3	150	H. H. Hinds, personal expenses	10 90	
					$544 56

Directors.

Sept.	10	24	I. H. Butterfield, personal expenses	$10 24	
"	10	26	I. H. Butterfield, personal expenses, postage, etc.	15 95	
"	10	27	E. W. Hardy, personal expenses, postage, etc.	3 55	
"	11	31	N. J. Kelsey, personal expenses, postage, etc.	33 29	
"	11	32	W. P. Custard, personal expenses, postage, etc.	49 10	
"	11	41	H. R. Dewey, personal expenses	45 61	
"	11	42	L. W. Barnes, personal expenses	19 55	
"	11	44	F. L. Reed, personal expenses, postage, etc.	38 08	
"	11	45	H. D. Cutting, personal expenses	10 60	
"	11	50	C. E. Lockwood, personal expenses	24 80	
"	11	51	M. J. Gard, personal expenses	25 38	
"	11	52	Wm. Chamberlain, personal expenses	15 85	
"	11	53	M. P. Anderson, personal expenses, postage, etc.	35 61	
"	11	54	Frank Maynard, personal expenses	16 20	
"	12	60	R. D. Graham, personal expenses, postage, etc.	10 05	
"	11	66	John Lessiter, personal expenses	23 56	
"	11	67	W. E. Boyden, personal expenses	24 60	
"	22	93	R. D. Graham, personal expenses	19 00	
"	22	119	H. S. Fralick, J. E. Hardy and H. D. Cutting, personal expenses	34 50	
"	22	127	F. E. Skeels, personal expenses	7 80	
Oct.	13	139	I. H. Butterfield, mailing tubes	2 00	
					465 32

President's Office.

Aug.	5	11	Wm. Ball, personal expenses	$42 90	
Sept.	11	64	Wm. Ball, personal expenses, postage, etc.	42 75	
"	11	65	E. N. Ball, clerk	14 90	
					100 55

Secretary's Office.

Feb.	13	304	H. S. Fralick, postage	$5 00	
May	18	2	H. S. Fralick, on salary	100 00	
July	8	5	H. S. Fralick, postage on premium list	50 00	
"	8	6	H. S. Fralick, express charges	5 39	
Aug.	12	12	H. S. Fralick, postage and express	30 00	
Sept.	12	72	R. E. Martin, clerk	60 00	
"	22	130	H. S. Fralick, express, telephone, etc	30 22	
"	22	131	H. S. Fralick, pay roll	148 00	
"	22	132	H. S. Fralick, postage, telegrams, etc	62 79	
"	22	135	H. S. Fralick, on salary	275 00	
Oct.	3	138	R. E. Martin, clerk	10 00	
"	3	144	H. S. Fralick, postage and express	3 00	
"	3	146	H. S. Fralick, on year's salary	125 00	
					$904 40

Treasurer's Office.

Sept.	12	78	C. W. Young, personal expenses and cash paid out	$40 00	
"	22	124	C. W. Young, pay roll	113 64	
"	22	134	C. W. Young, personal expenses	72 75	
"	22	136	C. W. Young, three-fourths year's salary	150 00	
Oct.	3	145	C. W. Young, one-fourth year's salary	50 00	
"	3	148	C. W. Young, personal expenses and postage	11 77	
					438 16

Judges.

Sept.	10	22	W. K. Sexton, cattle department	$5 00	
"	10	23	F. H. Johnson, cattle department	28 00	
"	10	25	G. B. Smith, cattle department	8 00	
"	10	29	H. W. Mumford, sheep department	20 36	
"	10	30	S. Butterfield, swine and poultry department	30 95	
"	11	34	Geo. Stewart, sheep department and Election	16 00	
"	11	35	A. A. Wood, election	2 50	
"	11	47	Miss E. Powell, needle department	14 00	
"	11	48	Mrs. R. E. Watson, needle department	6 00	
"	11	49	James Gray, horse department	33 10	
"	11	55	L. R. Taft, horticulture department	10 00	
"	11	56	A. P. Green, horticulture department	3 00	
"	11	57	M. L. Dean, horticulture department	5 00	
"	11	58	Chas. Bowditch, horticulture department	10 00	
"	11	59	W. N. Cook, horticulture department	6 00	
"	22	110	S. L. Wise, art hall	21 00	
"	22	111	S. B. Dikeman, art hall	16 00	
"	22	112	Maud W. Northrup, art hall	12 00	
"	22	126	J. D. Dart, vehicles	12 08	
Dec.	10	153		6 00	
					264 99

Printing and Stationery.

Sept.	11	69	C. J. Gregory & Co., tickets	$25 25	
"	22	82	Stanton Ptg. Co., premium list, etc	135 70	
"	23	91	Fair Pub. Co., tickets	31 25	
"	22	101	Eaton, Lyon & Co., stationery, etc	7 80	
"	22	103	Palmer Meech & Co., stationery and crayon	85	
					200 85

Telegraph and Telephone.

Sept.	22	84	Mich. Telephone Co	$10 85	
"	22	100	W. U. Telegraph Co	3 87	
					14 72

Insurance.

Oct.	3	151	W. H. Anderson, policies	$405 48	
"	26	152	Geo. A. Dyer, policy	112 50	
					517 98

Advertising.

June	12	3	Kauffman & Strauss, Ptg. cards	$28 50	
July	22	7	C. B. Crisp & Co., sign on building	20 00	
Aug.	4	9	Calvert Lithograph Co., posters	196 00	
"	10	20	W. F. McKnight, engaging speakers	100 00	
Sept.	11	38	The Herald, ad	50 00	
"	11	39	Evening Press, ad	50 00	
"	11	40	Democrat, ad	50 00	
"	46	46	H. D. Cutting, posting bills	9 50	
"	22	94	Sanders Pub. Co., ad	19 60	
"	22	95	Geo. M. Savage, ad	50 00	
"	22	96	Chicago Horseman, ad	14 50	
"	22	97	Horse Review Co., ad	16 50	
"	22	98	Western Horseman, ad	16 00	
"	22	108	Scheffer & Zenderveld, ad	4 65	
"	22	109	D. Schran	3 15	
"	22	120	C. B. Crisp & Co., sign painting	6 00	
"	22	121	G. M. Leonard and others, bill posting	427 64	
"	22	129	F. G. Eddy, bill posting	7 45	
	3	140	Bay City Bill Posting Co	12 50	
					1,081 99

Music.

Sept.	22	87	Frank Wurzburg, band	$204 00	
					204 00

Badges.

Aug.	4	8	C. S. Cole & Co., badges, fair 1895	$4 80	
Sept.	22	92	Whitehead & Hoag Co., badges	8 30	
"	22	107	Ex Ray Badge Co., badges	3 00	
					16 10

Gate Department.

Sept.	22	123	F. H. Latta, pay roll	$111 65	
					111 65

Police Department.

Sept.	11	43	N. J. Kelsey, pay roll	$678 96	
"	11	61	N. J. Kelsey, extra pay roll	16 00	
					694 96

Booth and Privileges.

Sept.	11	36	Myron Hester, expenses	$7 77	
"	11	37	Myron Hester, expenses	1 25	
"	11	71	Myron Hester, salary	50 00	
"	11	73	Myron Hester, pay roll	52 75	
					111 77

Buildings and Grounds.

Aug.	18	13	R. D. Graham, pay roll, fruit hall	$50 00	
"	27	14	R. D. Graham, lumber, fruit hall	38 08	
Sept.	9	18	John Dunham, mowing grass	12 25	
"	22	85	Spring & Co., decorating fruit hall	176 55	
"	22	86	Foster, Stevens & Co., hardware	5 58	
"	22	88	Chas. A. Coye, use of tents and flags	126 25	
"	22	99	Adams & Hart, use of tents and flags	10 00	
"	22	104	White & White, zenoleum	2 50	
"	22	105	Voight, H. &. Co., cloth	96	
"	22	106	Dolan & Muir, plumbing, etc	138 75	
"	22	114	Peter Brown, labor at grounds	43 00	
"	22	115	H. D. Plumb, supplies	25 46	
"	22	116	Geo. Snyder, labor at grounds	25 00	
"	22	117	J. C. Goss & Co., use of tents	26 00	
"	22	118	Fuller & Rice, lumber	171 26	
"	22	122	H. Dalehout, labor at grounds	6 00	
"	22	125	H. S. Fralick, secretary, pay roll laborers	139 35	
"	8	128	C. H. Hoffman, pay roll carpenters	34 42	

Oct. 3	142	Brown & Sehler, use of tents	$10 00	
" 13	141	D. W. Packard, use of tents	40 00	
" 13	147	H. Dalehout, moving chairs	10 00	
" 13	149	Peter Brown, hauling fish	10 00	
				$1,101 41

Speed Department.

July 8	4	American Trotting Association membership	$50 00	
Sept. 8	17	Eugene Fifield, superintendent, purses	1,500 00	
" 9	19	Eugene Fifield, superintendent, purses	600 00	
" 10	21	Eugene Fifield, superintendent, purses	1,200 00	
" 11	33	Eugene Fifield, superintendent, purses	900 00	
" 10	28	G. W. Atherson, contract, "Marion Mills"	300 00	
" 12	74	Sherwood Hinds, messenger	6 05	
" 11	76	Frank Heath, starting judge	42 50	
" 12	77	A. F. Kelsey and S. S. Bradt, timers and assistants	23 50	
" 11	79	W. P. Morris, track marshal	18 00	
" 12	80	Ralph Treat, attendant position St	5 00	
" 22	31	J. H. Case, flagman	7 50	
				4,652 55

General Expenses.

Feb. 13	302	C. F. Norton, display in agricultural hall	$10 00	
May 18	306	Alsdorf & Son's note	100 00	
Sept. 11	68	Eugene Fifield, overcharge at gate	2 50	
" 12	75	Peter Turney, rebate on gaming privilege	100 00	
" 12	83	G. H. Behnke, straw	166 23	
" 22	89	Harris Paper Co., paper, pie plates, etc	19 09	
" 22	90	Leonard Sons & Co., use of glasses and platters	1 40	
" 22	102	Hall & Telford, hacks, etc	7 00	
" 22	113	Security Co., hauling goods, safe, etc	21 90	
" 22	122	W. H. Anderson, note and interest	1,030 14	
				1,512 26
		Grand total		$12,884 22

SUMMARY.

Business committee	$1,674 70	Advertising	$1,081 99
Directors	465 32	Music	204 00
President's office	100 55	Badges	16 10
Secretary's office	904 40	Gate department	111 65
Treasurer's office	438 16	Police department	694 96
Judges	264 99	Booths and privileges	111 77
Printing and stationery	200 85	Buildings and grounds	1,101 41
Telegraph and telephone	14 72	Speed department	4,652 55
Insurance	517 98	General expenses	328 12

The following shows the entries in each class and division:

Division A—Cattle.

Class.		
1.	Shorthorns	49
2.	Devons	52
3.	Herefords	44
4.	Jerseys	64
5.	Galloways	27
6.	Aberdeen Angus	46
7.	Holstein Friesians	14
8.	Red Polled	26
9.	Grade	12
10.	Fat cattle	35
11.	Sweepstakes for dairy cows	5
	Special Hereford prize	12
		386

Division B—Horses.

Class.			
12.	Standard Bred Roadsters	73	
13.	Roadsters not standard	26	
14.	Carriage and buggy horses	20	
15.	Saddle horses	3	
16.	Horses of all work	24	
17.	Cleveland Bays		
18.	French Coach		
19.	Hackney		
20.	Percheron and French Draft	11	
21.	Clydesdale or English shire	10	
22.	Grade Draft	17	
23.	Shetland Ponies	24	
	Speed entries	157	
			365

Division C—Sheep.

24.	American Merinos	97	
25.	Rambouillet Merinos	64	
26.	Delaine Merinos	27	
27.	Merinos not registered	20	
28.	Lincolns	47	
29.	Leicesters	31	
30.	Cotswolds	33	
31.	Shropshires and specials	116	
32.	Hampshires	47	
33.	Oxfords and specials	65	
34.	Southdowns	32	
35.	Fat sheep	13	
			592

Division D—Swine.

36.	Berkshire	24	
	Essex	32	
	Suffolk, Small Yorkshire, etc	57	
	Poland China	130	
	Duroc Jersey	47	
	Chester White, etc	63	
	Fat hogs	4	
	Special for Berkshires	2	
	Special for Poland China	1	
	Special for Chester White		
			360

Division E—Poultry.

37.	Poultry	684	
			684

Division F—Grain and Vegetables.

38.	Grain and seeds	163	
39.	Vegetables	291	
40.	Professional display	4	
41.	Flour, meal and feed	10	
42.	Special county institute		
			468

Division G—Dairy Products.

43.	Butter, cheese, etc	26	
44.	Sugar, bread and pickles	56	
45.	Soap and toilet articles		
			82

Division H—Bees, Honey, etc.

46.	Bees and honey	57	
			57

Division I—Farm Implements.

47.	Farm implements	1	
			1

Divisions J and K—Vehicles and Machinery.

Class.			
48.	Vehicles, etc.	72	72

Division L—Manufactures.

49.	Wool samples	6	
50.	Leather and rubber		
51.	Furniture	2	
52.	Iron work, etc	5	
			13

Division M—Clocks, Jewelry, etc.

53.	Clocks, jewelry, etc	00	00

Division N—Painting, Drawing, etc.

54.	Painting, professional	206	
55.	Painting, amateur	150	
56.	Industrial art	43	
			399

Division O—Needlework.

57.	Plain needlework	60	
58.	Embroidery	379	
59.	Crochet and knit work	185	
60.	Children's	65	
			689

Division P—Miscellaneous.

61.	Miscellaneous	11	
62.	Household articles	1	
63.	Printing and stationery		
			12

Division R—Horticultural.

64.	Artistic exhibit of horticultural products	3	
65.	General collection, fruits for family use	17	
66.	General collection, fruits for market	12	
67.	Special exhibit of peaches	24	
68.	Special exhibit of pears	13	
69.	Special exhibit of plums	11	
70.	Special exhibit of grapes	27	
71.	Single plates of fruits—		
	Apples	753	
	Pears	221	
	Peaches	222	
	Plums	146	
	Grapes	108	
	Quinces	15	
	Cranberries		
72.	Dried, canned and preserved fruits	35	
73.	Plants and flowers in beds	8	
74.	Plants in pots	60	
75.	Cut flowers, boquets, etc	30	
			1,705
	Department of specials	405	405
	Total entries in all departments where premiums are offered		6,290

Recapitulation.

Division A.	Cattle	386
Division B.	Horses	365
Division C.	Sheep	592
Division D.	Swine	360
Division E.	Poultry	684
Division F.	Grain and vegetables	468
Division G.	Dairy products	82

Division H.	Bees, honey, etc	57
Division I.	Farm implements	1
Divisions J and K.	Vehicles and machinery	72
Division L.	Manufactures	13
Division M.	Clocks, jewelry, etc	
Division N.	Painting, drawing, etc	399
Division O.	Needlework, etc	689
Division P.	Miscellaneous	12
Division R.	Horticultural	1,705
Department of specials		405
Total		6,290

Premiums Offered and Awarded.

Cattle.

Class.		Offered.	Awarded.
1.	Shorthorns	$327 00	$315 00
2.	Devons	327 00	167 00
3.	Herefords	327 00	315 00
4.	Jersey	327 00	327 00
5.	Galloways	327 00	291 00
6.	Aberdeen Angus	327 00	277 00
7.	Holstein-Freisian	327 00	144 00
8.	Red Polled	327 00	242 00
9.	Grade Cattle	74 00	67 00
10.	Fat Cattle	159 00	149 00
11.	Milch Cows	15 00	15 00
	Total cattle	$2,864 00	$2,309 00

Horses.

12.	Standard bred	$265 00	$265 00
13.	Roadsters and Standard	153 00	107 00
14.	Carriage and Buggy	175 00	140 00
15.	Saddle	40 00	32 00
16.	Horses of all work	238 00	122 00
17.	Cleveland Bays	265 00	
18.	French Coach	265 00	
19.	Hackneys	265 00	
20.	Percheron	265 00	100 00
21.	Clydesdale	265 00	95 00
22.	Grade Draft	156 00	85 00
23.	Shetlands	124 00	80 00
	Total horses	$2,476 00	$1,026 00
	Speed	4,500 00	4,200 00
	Grand total	$6,976 00	$5,226 00

Sheep.

24.	American Merino	Dip.	$194 00	Dip.	$194 00
25.	Rambouillet Merino	"	144 00	"	144 00
26.	Delaine Merino, Dickinson or Blktp	"	144 00	"	144 00
27.	Merino ineligible to record		27 00		27 00
28.	Lincolns	"	134 00		100 00
29.	Leicesters	"	134 00		104 00
30.	Cotswolds	"	134 00	"	126 00
31.	Shropshires	"	146 00	"	146 00
32.	Hampshires	"	134 00	"	134 00
33.	Oxfords	"	134 00		79 00
34.	Southdowns	"	134 00		94 00
35.	Fat sheep		72 00		52 00
	Total sheep	10 Dip.	$1,531 00	6 Dip.	$1,344 00

Swine.

Class.					
36.	Berkshire	3 Dip.	$158 00	1 Dip.	$74 00
	Essex	3 "	158 00	3 "	66 00
	Suffolk, Small Yorkshire or Victoria	3 "	158 00	3 "	158 00
	Poland China	3 "	158 00	1 "	158 00
	Duroc Jersey	3 "	158 00	2 "	150 00
	Chester White, Cheshires, Large Yorkshires	3 "	158 00	3 "	126 00
	Fat hogs		29 00		18 00
	Total swine	18 Dip.	$977 00	13 Dip.	$750 00

Poultry.

37.	Poultry		$664 50		$279 00

Division F.

38.	Grain and seeds		$137 50		$98 50
39.	Roots and vegetables		175 00		116 00
40.	Professional gardeners		90 00		65 00
41.	Flour, meal, etc		39 00		12 00
	Total		$441 50		$291 50

Division G.

43.	Butter, cheese, etc		$63 00		$50 00
44.	Sugar, bread and pickles		80 00		60 00
	Total		$143 00		$110 00

Division H.

46.	Bees and Honey		$142 00		$142 00

Division J.

48.	Vehicles	14 Dip.*		12 Dip.*	

Division L—Manufactures.

49.	Wool, etc		$40 00		$15 00
50.	Leather and rubber		121 00		
51.	Furniture	silver medal, Dip.	202 00		
52.	Iron work		35 00		3 00
	Total		$398 00		$18 00

Division M.

53.	Clocks and Jewelry	9 Dip.			

Division N.

54.	Painting, sculpture, etc		$581 00		$455 00
55.	Painting and drawing by amateurs	Dip.	153 00		107 00
56.	Industrial art	13 "	89 00	11 Dip.	55 00
	Total	14 Dip.	$823 00	11 Dip.	$617 00

Division O—Needle and Fancy Work.

57.	Needle work		$28 50		$23 00
58.	Embroidery		150 50		86 50
59.	Crochet and knit work		63 50		47 50
60.	Childrens		35 25		12 00
	Total		$277 75		$169 00

*Silver cup and silver medal.

Division P.

Class.			
61.	Miscellaneous	38 Dip.	3 Dip.
62.	Household articles	18 "	1 "
	Total	56 Dip.	4 Dip.

Division R—Fruits.

64.	Horticultural products	$38 00	$33 00
65.	General collection of fruits, family use	60 00	60 00
66.	General collection market fruits	44 00	44 00
67.	Special exhibit of peaches	36 00	36 00
68.	Special exhibit of pears	36 00	36 00
69.	Special exhibit of plums	17 50	14 00
70.	Special exhibit of grapes	33 50	30 00
71.	Single plates of fruit	176 25	148 00
72.	Preserved fruits and jellies	80 00	76 00

Flowers and Plants.

73.	Flowers and plants in beds	$72 00	$72 00
74.	Plants in pots	211 00	186 00
75.	Cut flowers, boquets and floral designs	71 50	65 50
	Total, fruit, flowers and plants	$875 75	$800 50

Recapitulation.

Cattle	$2,864 00	$2,309 00
Horses	2,476 00	1,026 00
Sheep	1,531 00	1,344 00
Swine	977 00	750 00
Poultry	664 50	297 00
Grain, seeds, vegetables, flour and meal	441 50	291 50
Butter, cheese, sugar, bread, etc	143 00	110 00
Bees and honey	142 00	142 00
Wool, leather, rubber, furniture and iron work	398 00	18 00
Painting, drawing, etc	823 00	617 00
Needle, knit work and crochet	277 75	169 00
Fruit, flowers and plants	875 75	800 50
Total regular	$11,613 50	$7.874 00
Speed	4,500 00	4,200 00
Special premiums		1,000 00
	$16,113 50	$13,074 00
Diplomas		46
Silver cup and silver medal		1 each

[Copy.]

To the President and Executive Committee of the State Agricultural Society:

Gentlemen—Your committee on finance, to whom was referred report of secretary and treasurer, beg leave to report as follows: We have made a careful examination of their accounts and find upon examination of vouchers and receipts in their possession, to be correct as reported.

M. P. ANDERSON,
H. R. DEWEY,
W. P. CUSTARD,
Committee.

The executive superintendents presented reports of their departments for the fair of 1896, which were received and placed on file.

REPORT, SUPERINTENDENT OF CATTLE.

To the President and Executive Committee of the Michigan State Agricultural Society:

As acting superintendent of the Cattle Department for the fair of 1896, I respectfully submit the following report:

The exhibit of cattle at this fair was in my judgment very good. At many of our fairs we have had a larger exhibit, but in most of the classes for this year, the quality was decidedly good; this was especially true in Shorthorns, Angus, Herefords and Jerseys, very few inferior animals being brought into the ring. In the first three classes named, however, a larger part of the prizes went to herds from outside the State; not because our own breeders brought inferior animals, but with the herds from out of the State no pains nor expense had been omitted to put them in the best possible show condition, and I do not think the cattle breeders of this State, with their views regarding the inadvisability of extreme feeding for show purposes, will be able to successfully compete with these show herds. However, I have no changes to recommend in the classification or amount of premiums to be offered.

Very respectfully,

[Signed.] I. H. BUTTERFIELD,
Acting Superintendent Cattle.

REPORT, SUPERINTENDENT HORSES.

There was a fine exhibition of Clydes and Shires, the largest entrance and stock in the best condition that has been shown in a number of years.

Of standard bred, there was a large entrance in fine condition, and the competition was very close. In the other classes there was a full exhibit. In conclusion, I can say that, taking times and conditions into consideration, it was a very worthy show. I have some recommendations to submit to the premium list committee.

C. E. LOCKWOOD,
Superintendent Horses.

REPORT, SUPERINTENDENT SHEEP.

To the President and Executive Committee of the Michigan State Agricultural Society:

The entries in Division C were: American Merinos 97, Rambouillet Merinos 64, Delaine Merinos 27, Merinos not registered 20, Lincolns 47, Leicesters 31, Shropshires and specials 116, Hampshires 47, Oxfords and specials 65, Southdowns 32, fat sheep 13. Total, 592.

The exhibit in this department was exceedingly large and in most classes consisting of a great deal of merit. Harmony generally prevailed throughout. Have no recommendations to make.

Respectfully submitted,

[Signed.] JOHN LESSITER,
Superintendent of Sheep.

REPORT, SUPERINTENDENT SWINE.

To the President and Executive Committee of the Michigan State Agricultural Society:

Gentlemen—As superintendent of Division D, swine, I beg leave to make the following report:

Breed.	No. of entry.	Premium offered.	Premium awarded.
Berkshire	26	$158 00	$74 00
Essex	32	158 00	66 00
Small White Breeds	57	158 00	158 00
Poland China	131	158 00	158 00
Duroc Jersey	47	158 00	150 00
Large White Breeds	63	158 00	126 00
Fat Hogs	4	29 00	18 00
Totals	360	$977 00	$750 00

The exhibit as a whole was a very creditable one, both in numbers and quality of stock, and I think the swine industry of this country is so great as to command equal attention and recognition by our society with that of any other live stock interest. There are some matters regarding the rules and classifications in this department that I wish to bring before the proper committee. All of which is respectfully submitted.

[Signed.] L. W. BARNES,
Superintendent Swine.

REPORT, SUPERINTENDENT OF POULTRY.

To the Honorable Board of State Fair Committee:
As superintendent of Poultry Department, I would make the following report:

Total number of entries 684
Total number of birds shown 1,208

Different classes all well represented and good interest shown throughout the fair. Three tents were required, in addition to the building proper, for room to make the exhibit.

[Signed.] E. W. HARDY.

REPORT, SUPERINTENDENT AGRICULTURAL DEPARTMENT.

To the President and Executive Committee of the Michigan State Agricultural Society:

Gentlemen—At the last State fair held at Grand Rapids, the exhibition in Division F, farm and garden products, was of a high order and worthy of the attention it received from the multitude of visitors who thronged the hall at all hours of the various days of the fair.

The exhibition of potatoes was unusually fine and very large, and called out any amount of comment and discussion among growers and exhibitors. In corn the entries were numerous and the exhibits extra good and competition very close, and here I wish to say a word in regard to Mr. A. A. Crozier of the Agricultural College, who has been judge in this department for the last two years. He has created more interest in this department than I have ever seen before, by being able to decide between different exhibits in any class, and being able to make competitors see the difference in the different varieties. Many times his talk and discussion among visitors and exhibitors took on the look, almost, of Farmers' Institute, such was the interest manifested.

The exhibition of grains and seeds was equal to any had for many years past and the interest in wheats and field seed was quite marked. The exhibit of the Agricultural College of grains and seed, especially wheat, was very interesting to many farmers who asked Judge Crozier many questions in regard to the various kinds on exhibition.

On the whole, I think the fair, as far as Division F was concerned, was a great success.

Submitted by,
F. L. REED,
Superintendent Agricultural Department.

REPORT, SUPERINTENDENT BEES AND HONEY.

To the President and Executive Committee of the State Agricultural Society of Michigan:

Gentlemen—Your superintendent of the Department of Bees and Honey and the Dairy, would respectfully report: In the Bees and Honey Department there were 57 entries and six exhibitors. There was the largest, most artistically arranged, attractive and instructive display of honey ever exhibited at any State fair since I have had the superintendency of the department. I believe all the different breeds of bees were on exhibition for the study and instruction of all people interested in those wonderful little industrial insects.

As to the amount of premiums offered and paid, you are referred to the secretary's report. I have no recommendations to make in this department.

In the Dairy Department there were 82 entries; only three of these were cheese. Why the cheese-makers show so little interest in exhibiting their products at the State fair, is a question I have not been able to account for. There was a very large exhibit of butter of high quality. The refrigerator arrangement for preserving the butter in excellent condition was a complete success and convenient in handling.

There was the largest exhibit of bread of all kinds in use, made by the experience and skill of the better half of mankind. The special class in this department was well filled with specimens of bread and cake in all their known varieties. Much interest was taken by the ladies, in this department.

In the class of pickled vegetables, maple sugar and syrup, there were but few exhibits, but the goods were meritorious. There was no exhibit of sorghum products.

The Michigan State Dairymen's Association have employed Mr. E. N. Bates to attend the State fair two days during the fair to test milk and answer various questions in relation to making butter and cheese, and in the line of higher grades of products along that line.

He also performs the duty of judging the cheese and butter of which he is an expert, the society paying his hotel bills in consideration of such service. All of which is respectfully submitted.

[Signed.] M. J. GARD,
Superintendent Bees and Honey.

REPORT, SUPERINTENDENT AGRICULTURAL IMPLEMENTS.

To the President and Executive Committee of the State Agricultural Society of Michigan:

Gentlemen—I, being superintendent of the Agricultural Implement Department, would say that we had a very fine display of implements. Some departments were not as full as in 1895. The thresher department was short, also the drill department; their excuse for not exhibiting was on account of shrinkage in business and stringency in money matters. The exhibitors were all pleased with the courtesy they received from the executive committee.

Very respectfully,
[Signed.] W. P. CUSTARD,
Superintendent Agricultural Implement Department.

REPORT, SUPERINTENDENT MANUFACTURED GOODS.

To the President and Executive Committee, Michigan State Agricultural Society:

Gentlemen—As superintendent of manufactured goods, music and art, I beg leave to make the following report:

The exhibits in all departments were full and of exceedingly fine quality. The best of feeling prevailed and nothing came up to cause any annoyance. In the Art Department, I would recommend a revisal of the list by some good, competent persou who is up to date in art work.

Respectfully,

[Signed.] M. P. ANDERSON,

Superintendent Manufactured Goods.

REPORT, SUPERINTENDENT OF MACHINERY.

To the President and Executive Committee, State Agricultural Society:

Gentlemen—As superintendent of Division K, machinery, I would respectfully report:

Number of entries	3

Exhibit consisted of brick machine and flour milling machinery. No premiums were offered.

Sincerely,

[Signed.] F. E. SKEELS,

Superintendent Machinery.

REPORT, SUPERINTENDENT NEEDLE AND FANCY WORK.

To the President and Members of the Executive Commitee of the Michigan State Agricultural Society:

Gentlemen—As superintendent of Division O, needle and fancy work, I would report as follows:

Number of exhibitors	
Number of articles	687
Amount offered in premiums	$277 75
Amount awarded	$169 00

The space occupied by this exhibit was 372 running feet.

I would respectfully suggest that the professional and amateur exhibitors be placed in separate classes.

Respectfully submitted,

[Signed.] H. D. CUTTING,

Superintendent Needle and Fancy Work.

REPORT, SUPERINTENDENT MISCELLANEOUS DEPARTMENT.

To the Executive Committee of the State Agricultural Society:

In accordance with a rule requiring superintendents of various departments to submit an annual report, I respectfully present the following:

The number of entries in Division P, class 60, was 65; in class 61 was 2. The exhibit in this department was small. In view of the character of many of the exhibits in this department, I should deem it wise to award diplomas to all in the future, as we have in the past year. In the special exhibits the entries were large and the character of the exhibits good, furnishing a very interesting feature of the fair.

All of which is respectfully submitted,

[Signed.] FRANK MAYNARD,

Superintendent Miscellaneous.

REPORT, SUPERINTENDENT FORAGE.

To the President and Executive Committee of the Michigan Agricultural Society:

As superintendent of forage, I would state that total cost (601,090 pounds) of straw used was $166,23, as against $254.46 for 1895. Through the forethought of Mr. Fifield, superintendent of Speed Department, comes most of this saving by not furnishing straw to speed horses. The plan of having superintendents of departments needing straw, give orders for same, worked very well; think the amount of straw used was but little above what was actually needed.

[Signed.] W. E. BOYDEN,
Superintendent Forage.

REPORT, SUPERINTENDENT GATES.

To the President and Executive Committee of the State Agricultural Society:

Gentlemen—I had seven men employed at the gates at the last fair, in all 35 days time, which, with the necessary expense, cost the society $111.65. In this connection, let me thank C. W. Young who generously helped the chairman of this committee by taking charge when I was obliged to be away. The main matter we had that made this work unpleasant, and perhaps, in the estimation of some, unbusiness-like, was being obliged to collect cash from the passengers in the carriages at main gate, which, perhaps, was difficult to avoid.

Very respectfully.

[Signed.] F. H. LATTA,
Superintendent of Gates.

REPORT, SUPERINTENDENT OF POLICE.

To the President and Members of the Executive Committee of the Michigan State Agricultural Society:

Gentlemen—As has been our custom, a few trusty policemen were placed on duty at the fair grounds at Grand Rapids as early as Friday prior to the State Fair.

The whole number of police on duty at different times during the fair were 62, time ranging from one to eight or nine days each. The wages paid were $2 per day without board, lodging furnished the men, however, on the grounds at police headquarters, the secretary, Mr. Fralick, looking after the matter of cots and blankets and contributing generally to the comfort of the men, and in such a manner as to leave no cause of complaint. Thanks to the efficiency of the force and the assistance of the officials and city police, no complaints on accounts of pick-pockets or from pilfering were reported. Receipts from "fence jumpers" were $2, which amount was turned over to the treasurer of the society.

Messrs. Strong, Beach and Bates rendered us excellent service, as is their custom. The force, which included many of our old and trusty members, were zealous in the discharge of their duties, and are deserving of credit.

I desire to thank my brother members of the committee for their very kind consideration and assistance rendered me during the entire fair, and particularly are my thanks due the president of the society, Mr. Ball, who both worked with, and stood by the police department from start to finish, in our efforts to protect exhibit, exhibitor and patron.

Very respectfully,

[Signed.] N. J. KELSEY,
Superintendent Police Department.

Mr. Latta moved that protest from Mr. ——— be passed and the money paid to Mr. Morse.

On motion, a recess was taken to 12:00.

12:00. Committee called to order by the president.

The business committee reported that all claims of creditors except that of Mr. Nichols had been arranged for the present.

The committee appointed in reference to location for the fair for 1897 reported as follows:

Mr. President and Gentlemen of the Executive Committee of the State Agricultural Society Michigan:

Gentlemen—The committee elected to confer with a committee from Detroit to consider a proposition made by said Detroit committee to provide for holding the State Fair in Detroit for the years of 1897-8, would beg leave to report that we have carefully considered said proposition, and we recommend that it be accepted provided the details of arrangements can be concluded satisfactorily to both parties.

[Signed] H. R. DEWEY.
C. M. YOUNG.
R. D. GRAHAM.
C. E. LOCKWOOD.
A. H. ZENNER.

(This proposition provided that the citizens of Detroit would furnish grounds and buildings, the State Society to occupy them for the two succeeding fairs, the net receipts to be divided.)

It was moved by Mr. Butterfield that report be accepted and committee discharged. Carried.

(This proposition was not carried out by the citizens of Detroit, and hence was abandoned by the society.)

On motion, adjourned to 1:00 p. m.

1:00 p. m. Committee called to order by the president.

The report of the superintendent of speed was received and placed on file.

The superintendent of sheep made a verbal report recommending that the classes be not open to the world. Referred to the premium list committee.

It was moved by Mr. Butterfield that a committee be appointed, consisting of the business committee, the president, vice president and treasurer, to receive propositions on location for 1897.

The committee adjourned sine die.

LANSING, Feb. 25, 2:30 p. m.

The executive committee for 1897 was called to order by the president.

The following names answered the roll call: President Ball, Messrs. Butterfield, Barnes, Boyden, Custard, Cutting, Anderson, Fifield, Graham, Dewey, Hardy, Hinds, Gard, Latta, Lockwood, Lessiter, Kelsey, Skeels, Reed, Young, Zenner, and the secretary.

It was moved by Mr. Skeels that a ballot be taken for general superintendent. On motion the chair appointed two tellers, Messrs. Lockwood and Skeels. The ballot resulted as follows: Total number of votes cast, 22; of which Eugene Fifield received 13, H. H. Hinds 3, A. H. Zenner 2, scattering 4. Mr. Fifield was declared elected.

On motion, ballot was taken for second member of business committee; result as follows: Total number of votes cast 21, of which W. P. Custard received 14, scattering 7. Mr. Custard was declared elected.

Adjourned to 8:00 p. m.

8:00 p. m. Called to order by the president. Quorum present.

Report of the premium list committee received and read. On motion of Mr. Skeels, the report as a whole was adopted.

On motion of Mr. Young, the business committee was authorized to accept special premiums in their discretion.

Mr. Lockwood moved that the business committee be authorized to make a regular premium list. Mr. Fifield moved as a substitute that the matter be left to a committee of five. Carried.

The committee on rules reported, recommending certain changes. The report was adopted. (The report of the premium list committee and the committee on rules will be found in the premium list of the society for 1897.)

The officers of the Central Michigan Agricultural Society asked for a conference in regard to the fair grounds at Lansing. It was moved by Mr. Young that a committee of two, consisting of Messrs. Dewey and Butterfield, be appointed to confer with that society. On motion, the president was added to that committee.

On motion of Mr. Fifield, it was directed that the entries close August 28.

On motion of Mr. Fifield, the salaries of the secretary and treasurer were made the same as last year, viz., $500 per annum for the secretary and $250 per annum for the treasurer.

It was moved by Mr. Skeels that the committee on location of fair be empowered to negotiate with other parties if satisfactory arrangements cannot be made with Detroit. Carried.

It was moved by Mr. Boyden that the committee use their judgment in regard to the matter of a 25-cent rate for Monday, the first day of the fair. Carried.

The president appointed standing committees and executive superintendents for 1897. The following is the list of officers, committees and superintendents:

PRESIDENT—WILLIAM BALL, Hamburg.
VICE PRESIDENT—I. H. BUTTERFIELD, Lansing.
TREASURER—C. W. YOUNG, Paw Paw.
SECRETARY—HENRY S. FRALICK, Grand Rapids.

EXECUTIVE COMMITTEE.

TERM ENDING JAN'Y, 1898.

E. W. Hardy, Howell.
Frank Maynard, Jackson.
F. L. Reed, Olivet.
N. J. Kelsey, Marshall.
H. R. Dewey, Grand Blanc.
R. D. Graham, Grand Rapids.
John Lessiter, Pontiac.
H. H. Hinds, Stanton.
F. E. Skeels, Grand Rapids.
M. G. Gard, Volinia.

TERM ENDING JAN'Y, 1899.

Eugene Fifield, Bay City
L. G. Townsend, Ionia.
F. H. Latta, Battle Creek.
A. H. Zenner, Detroit.
L. W. Barnes, Byron.
W. P. Custard, Mendon.
H. D. Cutting, Tecumseh.
M. P. Anderson, Midland.
C. E. Lockwood, Washington.
W. E. Boyden, Delhi Mills.

EX-PRESIDENTS.

Charles E. Kipp, St. Johns.
E. O. Humphrey, Kalamazoo.
W. L. Webber, East Saginaw
George W. Phillips, Romeo.
Wm. Chamberlain, Three Oaks.
A. O. Hyde, Marshall.
T. W. Palmer, Detroit.

STANDING COMMITTEES AND EXECUTIVE SUPERINTENDENTS.

BUSINESS COMMITTEE.

Eugene Fifield, W. P. Custard, Secretary.

TRANSPORTATION COMMITTEE.

H. R. Dewey, F. E. Skeels, Secretary.

RECEPTION COMMITTEE.

A. O. Hyde, Wm. Chamberlain.

FINANCE COMMITTEE.

M. P. Anderson, H. R. Dewey, C. E. Lockwood.

PREMIUM LIST COMMITTEE.

C. E. Lockwood, L. W. Barnes. W. E. Boyden, M. P. Anderson, E. W. Hardy, John Lessiter, R. D. Graham.

COMMITTEE ON RULES.

H. R. Dewey, F. H. Latta, F. L. Reed.

PROGRAM COMMITTEE.

Eugene Fifield, W. P. Custard, Secretary.

PRINTING AND ADVERTISING COMMITTEE.

H. H. Hinds, Eugene Fifield, Secretary.

GENERAL SUPERINTENDENT.

Eugene Fifield.

CHIEF MARSHAL.

L. G. Townsend.

EXECUTIVE SUPERINTENDENTS.

Cattle—W. E. Boyden.
Horses, Speed—Eugene Fifield.
Horses, Roadsters, Draft and Pony Classes—John Lessiter.
Sheep—C. E. Lockwood.
Swine—L. W. Barnes.
Poultry—H. D. Cutting.
Dairy, Bees and Honey—M. J. Gard.
Farm and Garden Products—F. L. Reed.
Vehicles—H. R. Dewey.
Agricultural Implements—F. H. Latta.
Machinery—Frank Maynard.
Manufactured Goods, Music and Art—M. P. Anderson.
Needle Work and Childrens' Work—F. E. Skeels.
Miscellaneous and Special Exhibits, except special on Fruits—Frank Maynard.
Horticulture—R. D. Graham.
Gates—W. P. Custard.
Police—E. W. Hardy.
Forage—W. E. Boyden.
Booths and Privileges.—F. E. Skeels.

Recess was taken subject to the call of the president.

GRAND RAPIDS, June 16, 2:00 P. M.

Special meeting of the committee called by the president.

Present: President Ball, Messrs. Butterfield, Young, Fifield, Townsend, Latta, Custard, Lockwood, Boyden, Reed, Kelsey, Graham, Lessiter, Chamberlain, Hyde, and the secretary.

Mr. Fifield presented schedule of speed program for the fair. On motion of Mr. Reed it was adopted.

The following resolution was offered by Mr. Reed:

Resolved, That the president and secretary of the Michigan State Agricultural Society be, and they are hereby authorized, empowed and directed to execute and acknowledge a quit-claim deed of this date in blank, in consideration of the payment, discharge and satisfaction in full of all claims and demands, of every name and nature, held by the Ingham County Savings Bank, The People's Savings Bank of Ingham County, and the Central Michigan Savings Bank of Ingham County, and to deliver the same to the parties aforesaid or to whomsoever they shall direct, upon the surrender of all evidences of indebtedness, and the discharge and satisfaction of all claims; which deed having been prepared and having been read at large at this meeting, is hereby approved; and said president and secretary authorized, empowered and directed to acknowledge and deliver the same as hereinabove provided.

The resolution was adopted.

A proposition was received from the West Michigan Agricultural Society for holding the fair of 1897 on its grounds. Referred to special committee on location of fair.

On motion of Mr. Young, committee adjourned subject to call of the president.

REPORT OF GOGEBIC COUNTY AGRICULTURAL SOCIETY.

IRONWOOD, MICH., Dec. 18, 1896.

Secretary State Agricultural Association, Lansing, Mich.:

The undersigned officers of the Gogebic County Agricultural Society hereby submit the following report of the transactions of the said society during the past year of 1896. The society was incorporated on the 18th day of October, 1895, and at the annual meeting of the board of supervisors of Gogebic county, held on the 18th day of October, 1896, a tax levy of one-twentieth of one mill on the assessed valuation of the county was made for the use and benefit of the society. The levy amounted to $450, and by resolution of said board upon the request of the officers of the society, the said sum was appropriated towards the construction of an exhibition building for the use of the society. At the annual meeting of the county board, held the 16th day of October, 1896, another tax levy of one-tenth of one mill was made for the use of the society, which will become available during the year 1897. This appreciation of the society and its aims and objects by the board of supervisors has contributed much towards its success and gives assurance of its future prosperity and usefulness. Without it, it is doubtful if the society could have made a success. Plans were laid and preparations began early in the year for holding a county fair at some time during the fall. A ladies' auxiliary was organized in connection with the society, and at once met with success. The household, art and educational departments were placed under their control, and they evinced a lively interest in the matter from the start. Preparations were soon made and contracts let for the construction of an exhibition building to be erected on the city driving park in the city of Ironwood, of whom a lease had been secured. The dimensions of the building are 48 x 98 feet, and is a very substantial building costing $1,200. Nearly four hundred dollars were spent in improving the race track and grounds. After all arrangements had been made for the fair and it gave every evidence of proving a brilliant success, the financial depression in the early part of the summer caused the mines here to close, and as this threw the bulk of our population out of employment and made the financial success of the fair doubtful, it was thought best after careful consideration to postpone the fair until another year. If conditions are favorable a fair will unquestionably be held during the year 1897, and it will undoubtedly prove a great success.

The farming industry in the county has increased very much during the past few years, and it is expected to continue to do so in the future. The possibilities of successful farming in this county has been fully demonstrated.

The financial report of the secretary and treasurer is attached hereto.

W. S. GOODLAND,
President.

C. E. HOUK,
Secretary.

JOHN W. MULLEN,
Treasurer.

DISBURSEMENTS.

Thos. Kissane, drawing incorporation papers	$5 00
Bennett & Green, printing circulars	12 00
Peaslee & Douglas, printing order blanks	4 00
Bennett & Green, " postal cards	1 75
" " " premium list	40 00
" " " dodgers, etc.	11 00
Wildhaugen & Rittinghaus, architects	15 00
A. D. Garner, insurance	25 00
Beautifying grounds	373 06
Fair building, per contract	1,200 50
Total	$1,697 31

C. E. HOUK,
Secretary.

JOHN W. MULLEN,
Treasurer.

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